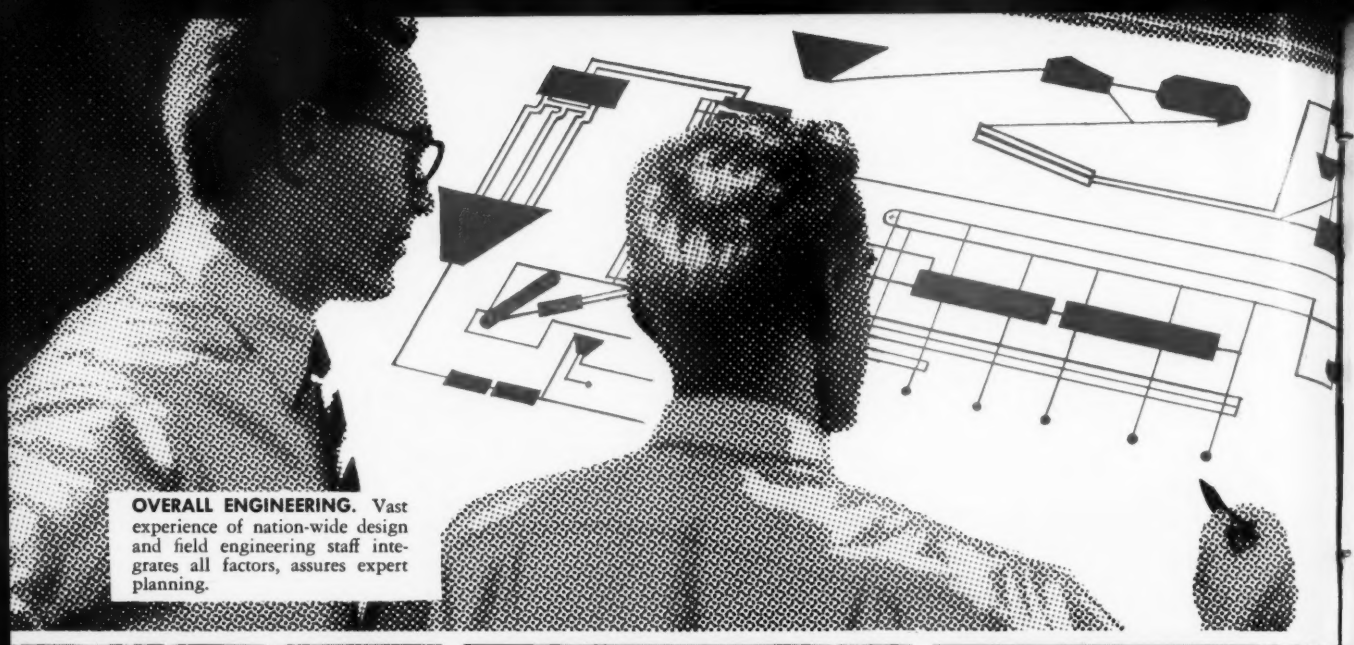
Mining

AMC

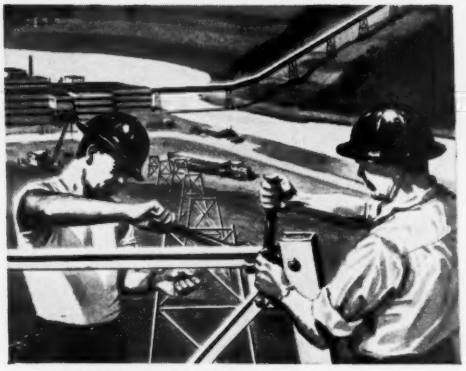
CONGRESS JOURNAL

Season's Greetings

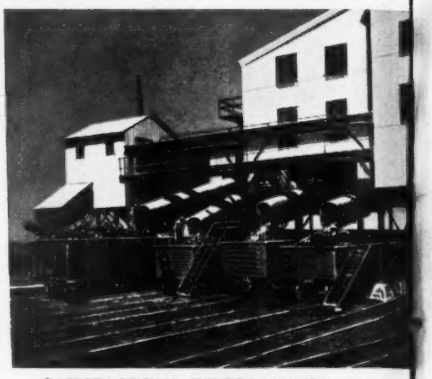


OVERALL ENGINEERING. Vast experience of nation-wide design and field engineering staff integrates all factors, assures expert planning.

QUALITY EQUIPMENT. Link-Belt builds the broadest line—you get a range of choice in all items, most warrantees from same source.



COMPLETE ERECTION. Experienced erection superintendents, staffs and skilled crews carry through entire job down to the last detail.



SATISFACTORY PERFORMANCE. When you rely on Link-Belt as a single source, Link-Belt accepts unified responsibility for overall operation.

Here's a unique "turn-key" service

that assures you the best in coal preparation

LINK-BELT accepts unified responsibility for design, manufacture and erection of complete coal preparation plants

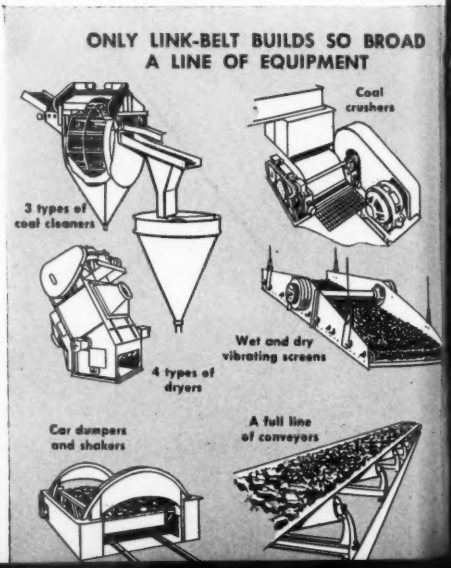
IF you're planning a new coal preparation plant—or the modernization of an existing one—Link-Belt can help you produce a better product at lower cost per ton. From this *single, proved* source, you get unequalled facilities for the design, engineering, manufacture and erection of complete coal preparation plants.

Link-Belt builds a broad line of quality preparation and conveying equipment. Our engineers can select the components that best meet your over-all requirements. And Link-Belt will handle every detail throughout the entire job . . . then place your plant in full operating readiness.

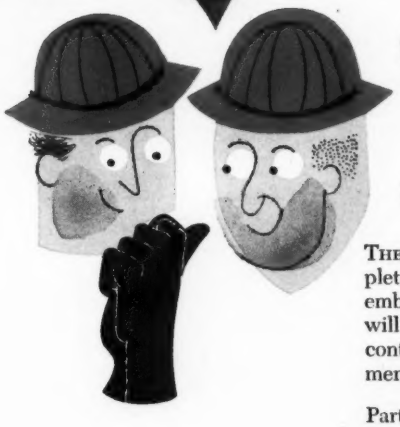
For information on how you can put this "turn-key" service to work for you, call your nearest Link-Belt sales office. Our engineers will be glad to sit down with you and analyze your requirements. There's no obligation, of course.

LINK-BELT

COAL PREPARATION AND HANDLING EQUIPMENT


ONLY LINK-BELT BUILDS SO BROAD A LINE OF EQUIPMENT
Coal crushers
3 types of coal cleaners
Wet and dry vibrating screens
4 types of dryers
Car dumpers and shakers
A full line of conveyors

LINK-BELT COMPANY: Chicago 9, Birmingham 3, Cleveland 15, Denver 2, Detroit 4, Huntington 9, W. Va., Indianapolis 6, Kansas City 8, Mo., Louisville 2, Pittsburgh 13, Seattle 4, St. Louis 1, Wilkes-Barre, Scarboro (Toronto 13), Springs (South Africa). 13,301

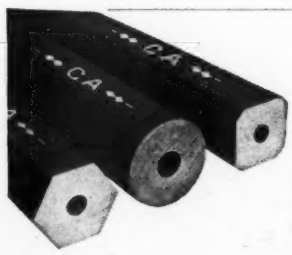


they're using CRUCIBLE HOLLOW DRILL RODS at FOLSOM DAM

THE FOLSOM DAM project is a big construction job. When completed it will be 340 feet high, 1400 feet long—with wing embankments extending for more than two miles. The new dam will provide a source for irrigation and power, and serve to control flood conditions in the American River Basin near Sacramento, California.

Part of the construction work involves the excavation of more than 9 million cubic yards of earth and rock. Here's where Crucible Hollow Drill Rods are playing a mighty important role. They can't be beat when it comes to hard rock drilling operations.

Crucible Hollow Drill Rods are made to tool steel standards by the world's largest producer of tool and other special purpose steels. This *extra* quality assures you of minimum rod breakage . . . and fewer valuable bit losses. For dependability in rock drilling, buy Crucible Hollow Drill Rods.



CRUCIBLE first name in special purpose steels

53 years of Fine steelmaking **HOLLOW DRILL ROD**

CRUCIBLE STEEL COMPANY OF AMERICA, GENERAL SALES OFFICES, OLIVER BUILDING, PITTSBURGH, PA.

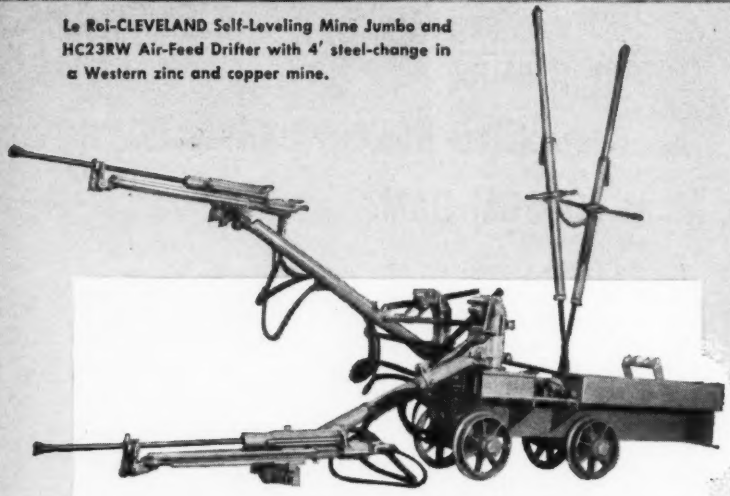
REX HIGH SPEED • TOOL • REZISTAL STAINLESS • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

A compact Le Roi-CLEVELAND Air Motor powers the arm of this mine jumbo — miners can take it easier, yet get more done.

Space, Spot,

Jumbo shown is equippped with a Le Roi-CLEVELAND DR34 air feed. It is available also with HC23RW reverse air feed, or can be used with any of the Le Roi-CLEVELAND Drifters.

Le Roi-CLEVELAND Self-Leveling Mine Jumbo and HC23RW Air-Feed Drifter with 4′ steel-change in a Western zinc and copper mine.



1 Le Roi-CLEVELAND 2-Boom Jumbo with power-feed drifters about to go underground.

2 Six-drill jumbo with Le Roi-CLEVELAND power-feed drifters and air-motor booms mounted on a 1½-ton truck for tunnel job.

3 Le Roi-CLEVELAND Jumbo equipped with long-feed drifters for use with carbide-insert bits.

4 Air-motor-powered booms give fast, solid set-ups. It's mechanically impossible for booms to drift during the drilling operation.

Le Roi-CLEVELAND MDR Jumbo

Le Roi-CLEVELAND Jumbos — equipped with air-motor-powered booms — reduce set-up time, drill out the round faster, shorten tear-down time.

To spot his drifter, the miner simply opens a conveniently located operating valve. Then a powerful, compact Le Roi Air Motor takes over, raising or lowering the boom rapidly to the desired drilling position.

What's more important, the boom stays where it's put. Drifters stay in line — there's no steel binding, no wear-and-tear on chucks. Average drilling speeds are higher.

Write for complete information.

and Drill Holes Faster!

Speed drilling cycles!

Get better fragmentation!

Save time drilling lifters!

Speed loading cycles!

Use a Le Roi-CLEVELAND Self-Leveling Mine Jumbo

with 4' steel-change Air-Feed Drifter

Want to get more drilling done per man-shift? Here's an easy way to go about it: Give your miners a Le Roi-CLEVELAND Self-Leveling Jumbo. It has everything they need to do the work you want — and cut your costs, too.

It has a self-leveling air-motor-powered arm. And that means miners can spot and space holes quickly and easily, for the most efficient fragmentation. They don't have to loosen a bolt or tilt a boom, to complete the drilling cycle.

It has an exclusive rigid screw and gearing mechanism that keeps the heading straight, cuts down overbreak and underbreak. It also keeps the drifters in line, prevents the steel from binding, reduces chuck wear.

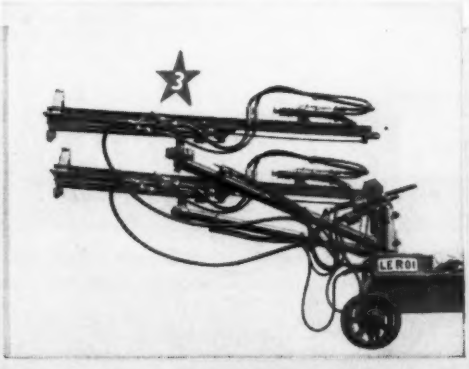
It has an offset arm that provides plenty of clearance to drill lifters. Miners don't have to take time out to swing the drill under the arm.

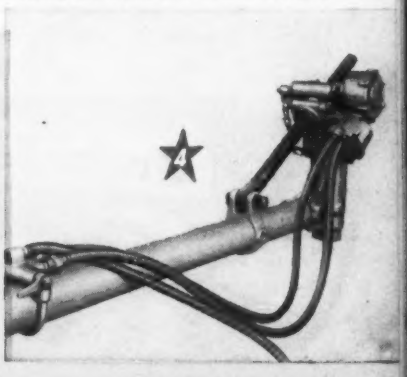
Together, these Le Roi-CLEVELAND features add up to faster cycles, greater tonnage per man-shift, lower costs! And that's why you owe it to yourself to get further information on both the single-arm and double-arm models. Write us today.

CLEVELAND ROCK DRILL DIVISION

Le Roi Company *A Subsidiary of Westinghouse Air Brake Co.*

12500 BEREA ROAD • CLEVELAND 11, OHIO *Plants:* Milwaukee, Cleveland and Greenwich, Ohio





RD-53

THESE REPOINTERS ARE
wear-conditioned

*U. S. Pat. No. 2, 247, 202

Because they are AMSCO "Wear-Sharp"* Repointers that stay sharper with use...

Service life plus! The combination of Amsco Manganese Steel and the hardness of AMSCOATING with Amsco Hardfacing electrodes—gives you a tooth that wears evenly and stays sharp longer.

Note that only certain grooves (shown in red at left) are Amscoated—the grooves on the outside and the one on each end. This is the area where ordinary teeth wear fastest. The hardened corners on the "Wear-Sharp" equalize wear along the entire cutting edge and eliminate rounded, blunted corners that cut digging speed and waste power.

Field reports indicate that "Wear-Sharp" repointers will give as high as six times the life of other teeth.

In these photographs at right of a typical case history, old repointers lasted from three to four days. Amsco "Wear-Sharp" repointers lasted 32 days—eight times the service life of the repointers previously used.

"Wear-Sharp" repointers installed on two dipper teeth showing condition of old teeth.

Notice the even wear on these teeth after 257 hours of use with "Wear-Sharp" repointers used. New "Wear-Sharps" are ready for installation.

AMERICAN Brake Shoe COMPANY

AMERICAN MANGANESE STEEL DIVISION

422 EAST 14th STREET · CHICAGO HEIGHTS, ILL.

Other Plants: New Castle, Del., Denver, Oakland, Cal., Los Angeles, St. Louis. In Canada: Joliette Steel Division, Joliette, Que.
Amsco Welding Products distributed in Canada by Canadian Liquid Air Co., Ltd.

DECEMBER, 1953

VOLUME 39 • NUMBER 12

Mining CONGRESS JOURNAL

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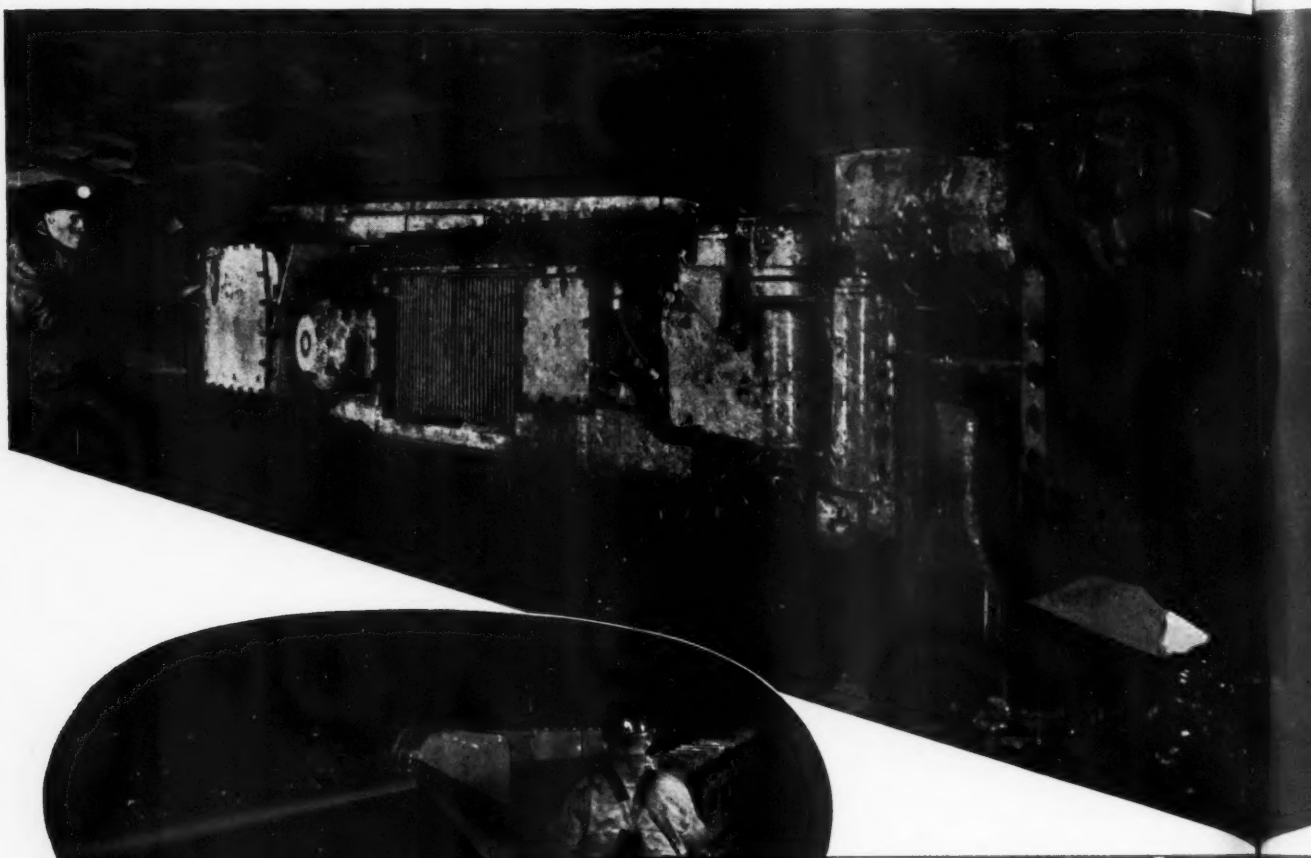
JEFFREY continues



MINES AND LOADS IN ONE

Top photo—a No. 76-A COLMOL mining by the popular "offset cut" method. An entry approximately 16-feet wide can be driven in two passes of the unit. Cutting range from 38" to full height of seam. A low-type unit is shown at right—above.

In oval—coal travels back on discharge conveyor at the rate of from two to four tons per minute. Coal is generally discharged into shuttle cars for transportation to a belt conveyor or mine cars.

POWERFUL
RUGGED
COMPACT
FAST

to modernize coal mining

THE COLMOL

OPERATION WITHOUT USE OF EXPLOSIVES

This safe, rapid method of mining large quantities of coal has introduced a new conception of modern mining . . has become an important contribution to the industry. With a single unit, coal is mined and loaded without the use of explosives. The COLMOL has eliminated the necessity for separate drilling, cutting and loading equipment. Production from this machine will run from 40 to 80 tons per man shift depending upon the height of coal.

Information on the COLMOL—what it is, how it is built, how it works, what it can do —will be sent on request.

THE JEFFREY MANUFACTURING CO.

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Columbus 16, Ohio

sales offices and distributors in principal cities

PLANTS IN CANADA, ENGLAND, SOUTH AFRICA.

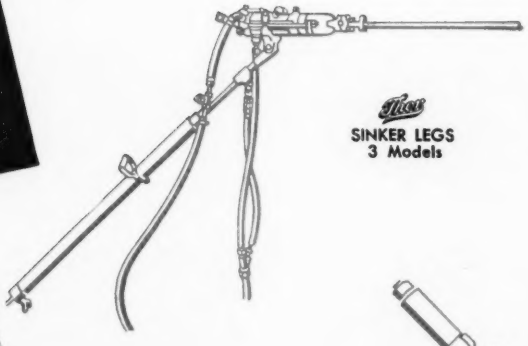
IF IT'S MINED, PROCESSED OR MOVED

. . .IT'S A JOB FOR JEFFREY!

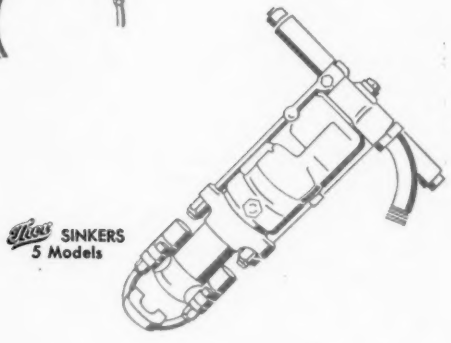
Reduce Mining Costs

with Thor ROCK DRILLS POWER FEEDS

No. 380 DRILLING MACHINE



Thor SINKER LEGS 3 Models



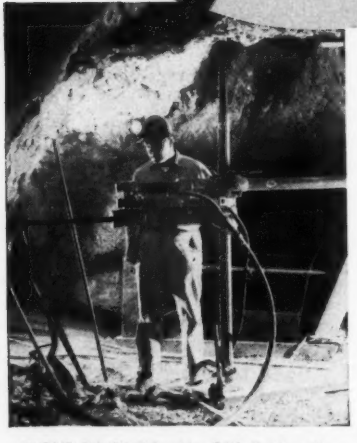
Thor SINKERS 5 Models

For economies in blast-hole drilling, modernize with powerful Thor Rock Drills, supported and fed by the new Thor Power Feeds—developed for rapid set-up, quick steel change, and fast, low-cost drilling with carbide-tipped bits.

THOR ROCK DRILLS assure maximum use of your air power, plus long tool service and low maintenance costs.

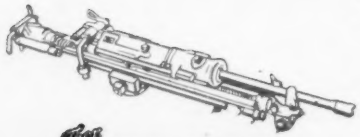
THOR AUTOMATIC AIR FEEDS—air motors, air bars and air legs—provide maximum flexibility and power with complete safety and control.

WRITE FOR CATALOGS, INFORMATION OR DEMONSTRATION



ABOVE, IN CIRCLE—No. 380 Drilling Machine with air-water backhead. 6 additional Sinker Leg models. IN SQUARE, Thor Air Bar Feed (4 models) and Thor Air Columns (3 models to 14 ft.).

BELOW: Thor Stopers, standard or reverse feed (6 models).



Thor POWER FEED DRIFTERS
3 Drill Sizes, 6 Shells to 60"+60"

THOR POWER TOOL COMPANY
AURORA, ILLINOIS

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Thor PORTABLE POWER TOOLS

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INCLUDES

Description of the most complete line of wires and cables for the Coal Mining Industry.

It's A Guide To

- ★ selecting the correct wire and cable
- ★ to splicing and patching
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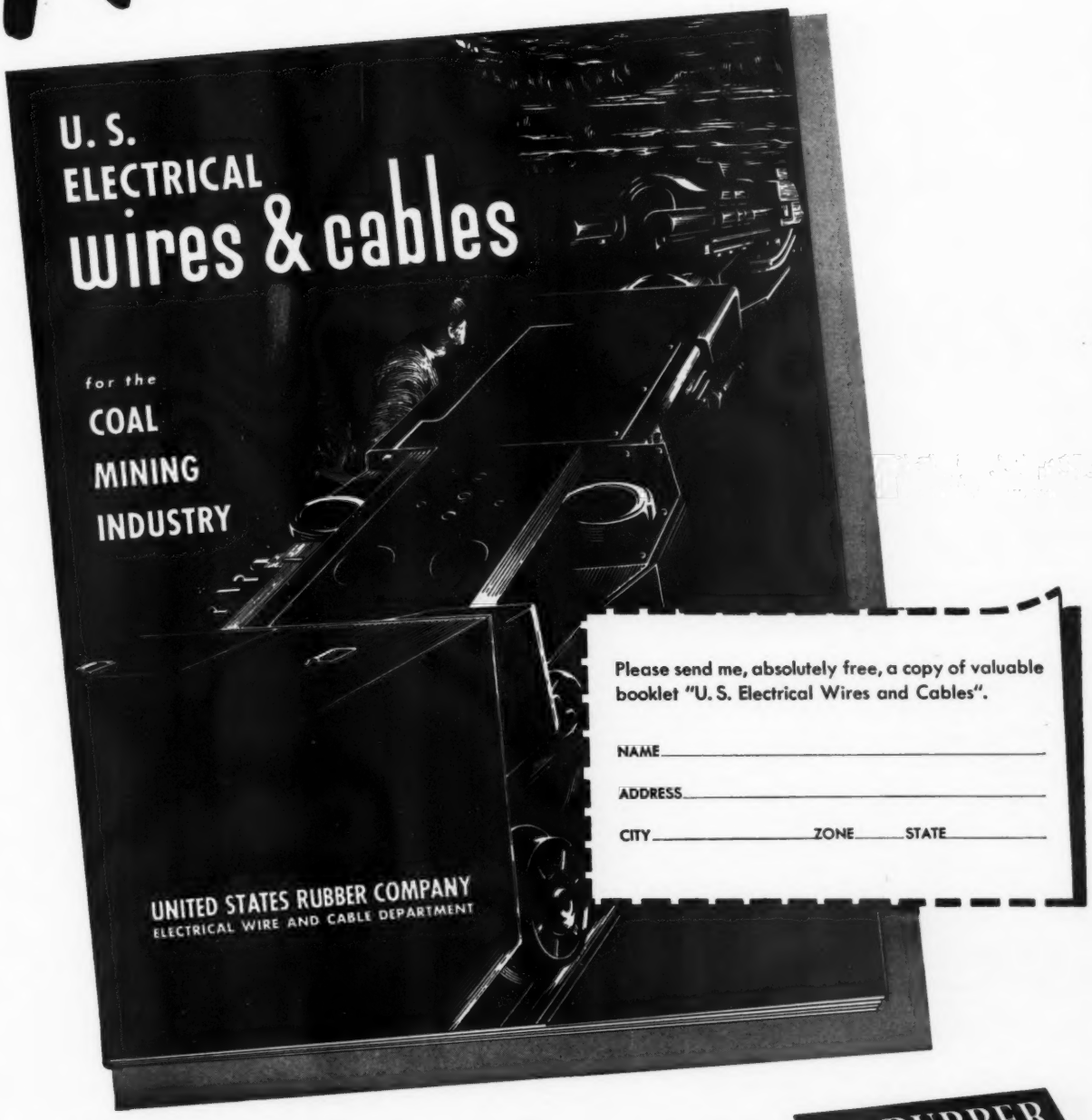

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EXPERIENCE is the truest guide to production efficiency and economy... and experience throughout the mining industry proves that Roebling wire rope is your one top choice for avoiding delays, cutting down replacements and saving wire rope dollars.

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You Get BOTH with "Eucs"

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RUGGED SIMPLICITY

Designed and built for long life and low maintenance cost. All of Euclid's experience and facilities are devoted to specialized off-the-highway earth moving equipment.

CAPACITY

Euclids have payload capacities of 10, 15, 22, 34 and 50 tons. Because they are matched to various sizes of loading and crushing equipment, "Eucs" provide a well balanced operation for open pit haulage and increase the efficiency of the loading unit.

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Powered by diesel engines of 125 to 600 h.p. "Eucs" have top speeds with full payload, up to 36 m.p.h. Five and ten speed transmission, or torque converter with semi-automatic transmission available. The favorable ratio of horsepower to payload means more pay tons hauled every trip.

VERSATILITY

"Eucs" are efficient for moving any material on any length of haul; handle overburden, rock, coal, ore and other materials loaded by shovels, draglines, transfer hoppers and mobile loading equipment.

If you are interested in higher production at lower cost, have your nearby Euclid Distributor show you what "Eucs" are doing on work similar to yours. He'll be glad to make a hauling cost estimate for your job—no obligation, of course.

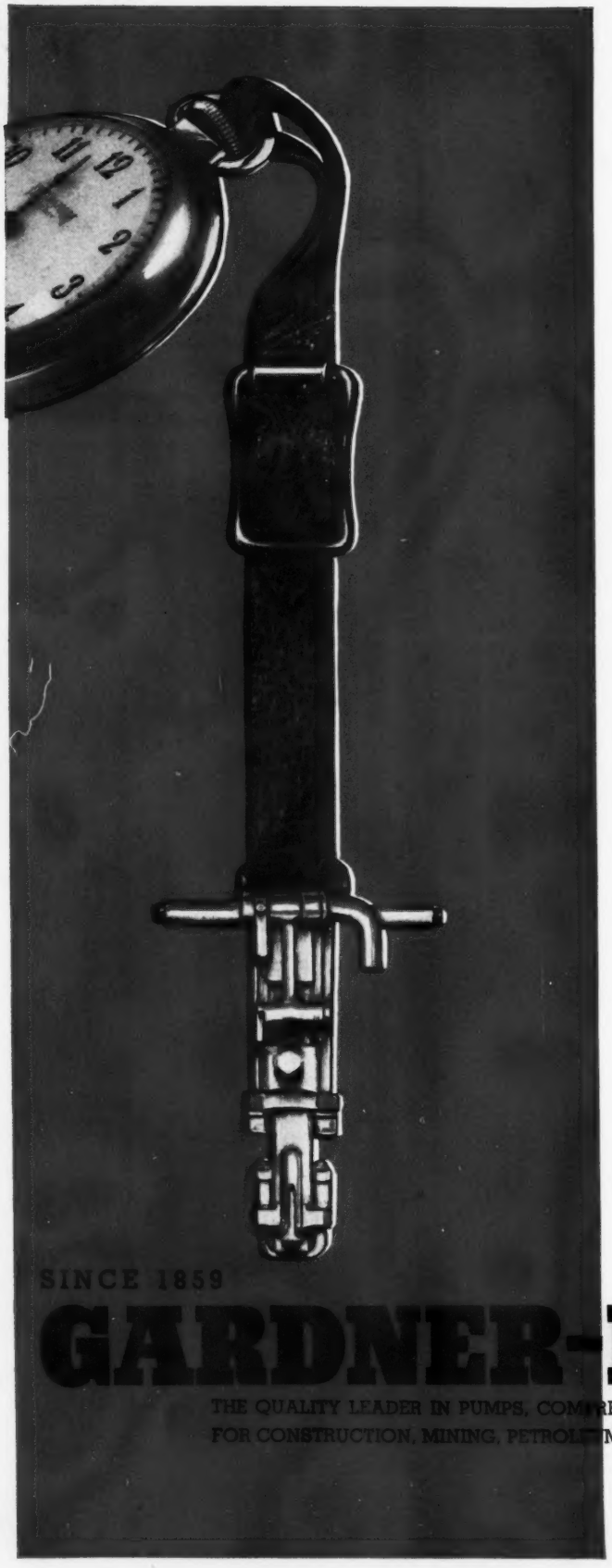
The EUCLID ROAD MACHINERY Co.

SUBSIDIARY OF GENERAL MOTORS CORPORATION

Cleveland 17, Ohio

Euclid Equipment

FOR MOVING EARTH, ROCK, COAL AND ORE



mark of the HARD ROCK MINER

For many years, this handsome Gardner-Denver watch fob has been presented to miners.

In mines throughout the world, it has become the symbol of the "hard-rock man"—and a token of the esteem in which he holds Gardner-Denver equipment.

Gardner-Denver Company
Quincy, Illinois

SINCE 1859

GARDNER-DENVER

THE QUALITY LEADER IN PUMPS, COMPRESSORS AND ROCK DRILLS
FOR CONSTRUCTION, MINING, PETROLEUM AND GENERAL INDUSTRY

The team that pulls production up

Goodman Cable Reel Shuttle Cars

. . . for rapid transfer of coal to haulage stations.

Type 570-571† 48″ ht.
Type 580-581† 42″ ht.
Type 582-583†† 42″ ht.
Type 370-371† 35″ ht.
Type 374-375†† 34″ ht.
Type 870 † 29″ ht.

†Elevating discharge
††Fixed discharge

Goodman Swing-Motion Loaders

. . . for fast, complete loading in wide face rooms or in pillar extraction.

Type 665—tramming ht. 41½″
Type 666—tramming ht. 36½″
Type 660—tramming ht. 33″
Type 865—tramming ht. 26½″

It will pay you to investigate this working combination that delivers profitable performance between face and haulage system. See your Goodman salesman.

Goodman
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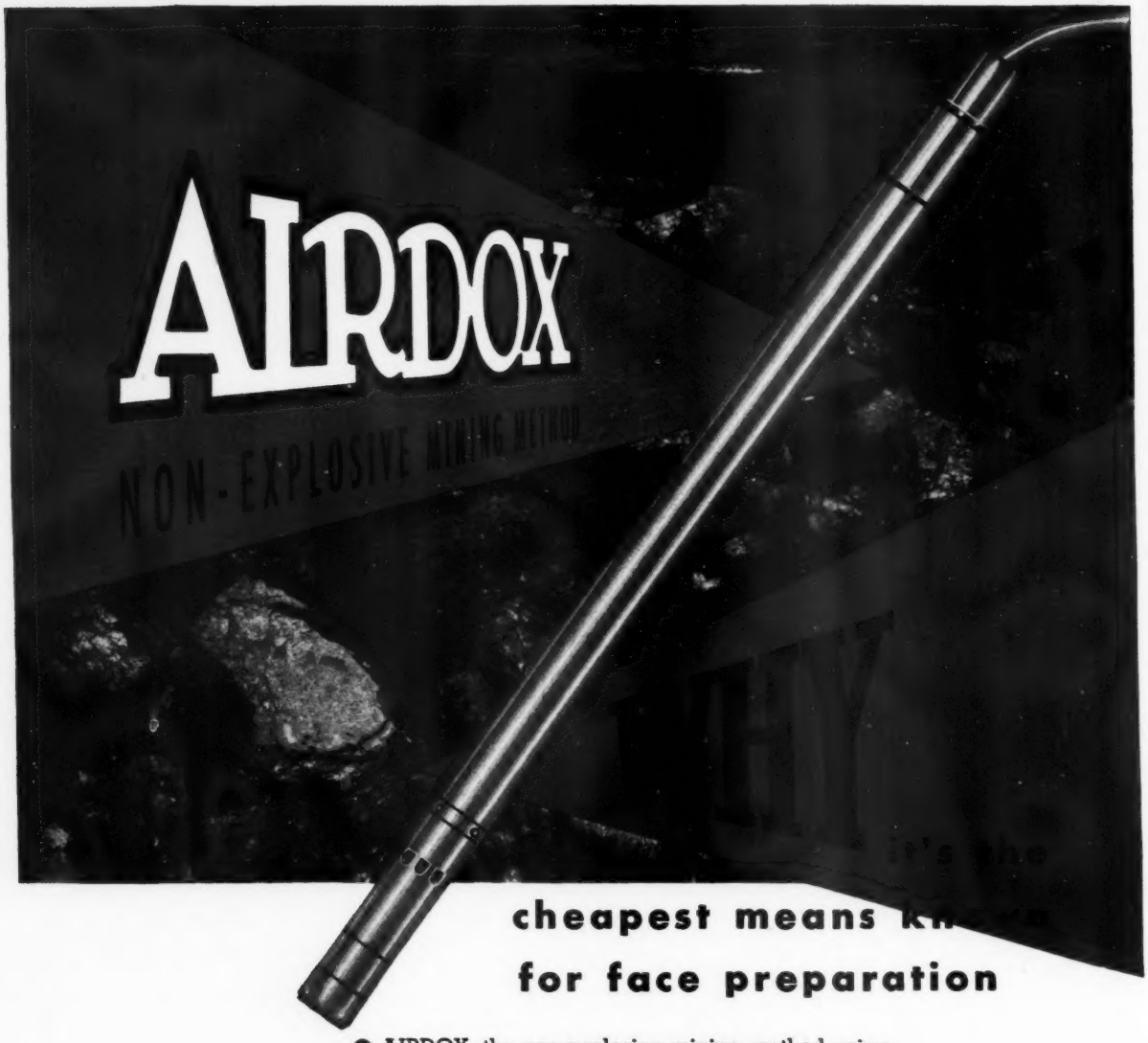
Cutting Machines · Conveyors · Loaders · Shuttle Cars · Locomotives · Continuous Miners



cheapest means k[illegible]
for face preparation

● AIRDOX, the non-explosive mining method using compressed air, has proven conclusively that it can produce coal at lower cost per ton than any other mining method. There are three major reasons why:

- **Almost without exception, the actual cost per ton of dislodging is less with AIRDOX.**
- **The manner in which AIRDOX dislodges the coal materially increases its loadability.**
- **Cleaning costs are reduced because of the comparative lower percentage of fines.**

Add the further benefits of greater safety and protection of roof structure and you can see why mines are increasingly turning to AIRDOX as a means to increase the profit spread of their operations.

Why not see what AIRDOX can do for you? Write and we'll arrange a free survey.

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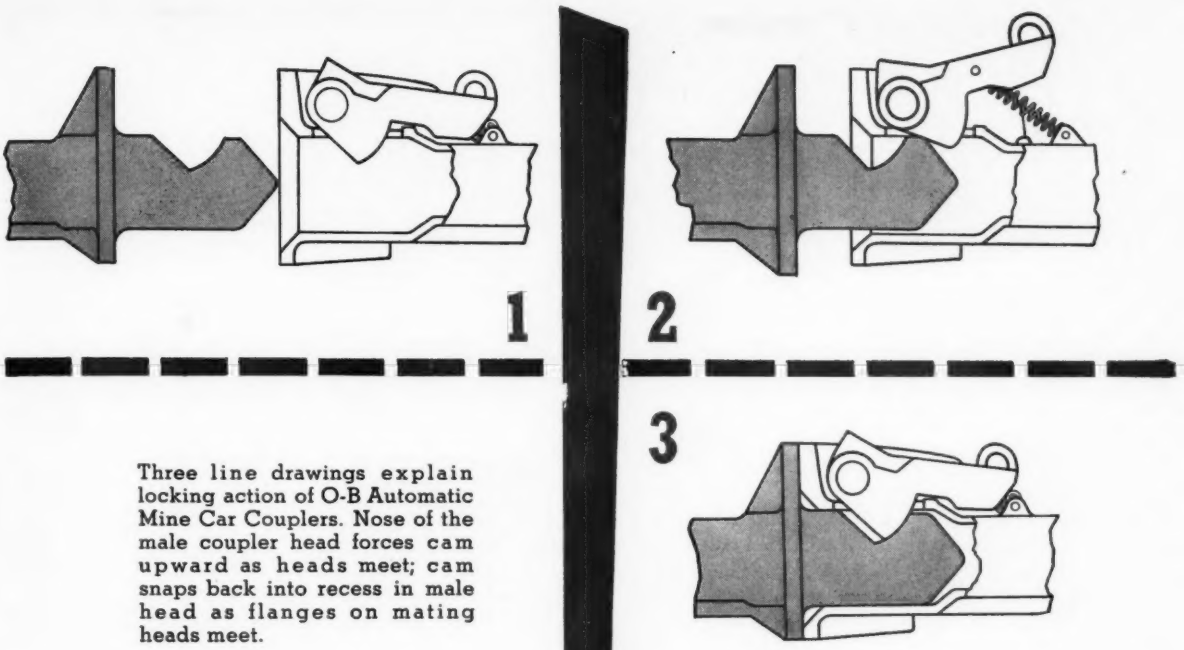


Three line drawings explain locking action of O-B Automatic Mine Car Couplers. Nose of the male coupler head forces cam upward as heads meet; cam snaps back into recess in male head as flanges on mating heads meet.

O-B Couplers Lock Tight on Impact

FOOL-PROOF CAM GIVES POSITIVE INTERLOCK

Just *one* sturdy cam locks mating O-B Coupler heads tightly and positively. One cam, housed in the female head, drops into the recessed male head, and both are immediately fixed with respect to one another. The cam cannot creep, nor can it be jolted from its seat by hard use. Cars uncouple only when a handler lifts the cam from its seat in the male head.

This is a simple, fool-proof locking mechanism. Few moving parts minimize chances for damage to the lock. Note that the cam tends to drop deeper into the male head recess when pull is applied. Note also that push on the male head cannot tip the cam upward, for movement between heads is impossible when they are locked together.

Positive interlock between mine cars adds speed and safety to any haulage system. That's one pretty good reason for choosing O-B for your new or remodeled cars!

Ohio Brass

MANSFIELD OHIO, U.S.A.

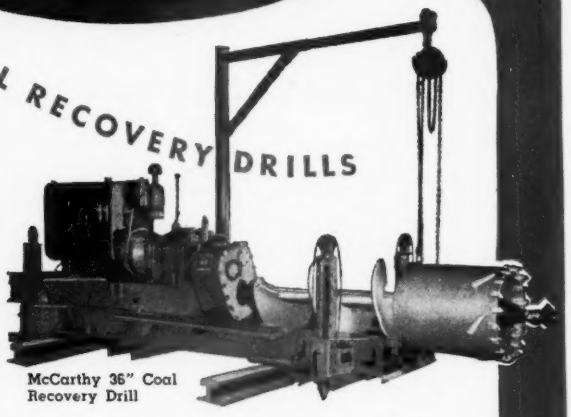
4352-AW

McCarthy drills CUT DRILLING COSTS

BLAST HOLE DRILLS

At Bessemer Limestone and Cement Co., Bessemer, Pa., one McCarthy Blast Hole Drill, like the one pictured below, averaged 90 ft. an hour, working through a hard blue shale facing 34 ft. deep. Holes were drilled on 18 ft. centers. Two men handled the whole job, including set-up and moving. Bessemer officials were so pleased with the performance of the McCarthy Drill that a second one was ordered and put to work in another section of their quarry. It, too, is breaking all previous records for fast, low-cost shot hole drilling.

COAL RECOVERY DRILLS



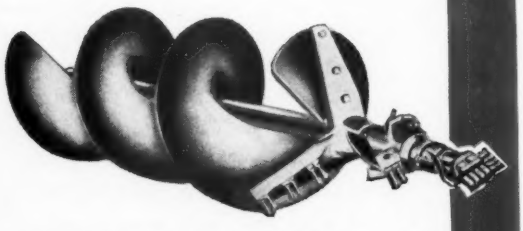
McCarthy 36" Coal Recovery Drill

Near Salineville, Ohio, a three-man crew, operating a McCarthy Coal Recovery Drill, similar to the one shown above, produced 90 tons of clean, high-grade and profitable coal in one eight-hour day. At Germano, Ohio, a three-man crew, using a 36" diameter auger section, produced 167 tons of coal in one eight-hour day!

Hydraulically controlled and operating on gasoline, diesel or electric power, rugged McCarthy Coal Recovery Drills produce coal at $1.50 to $2.00 a ton, including amortization of investment cost. You can select from four models . . . 20" to 24", 30" to 36", 42" and 48" diameters with 4-ft. to 24-ft. auger sections. Write Salem Tool direct and a distributor will call on you.

Heavy Rugged Powerful

McCarthy Model 106 Vertical Drill



THE SALEM TOOL COMPANY

779 S. ELLSWORTH AVE. SALEM, OHIO, U. S. A.

SALEM

Self-propelled high-wall Blast Hole Drill

24" Coal Recovery Drill

"Our engines have remained clean"

THE MAUMEE COLLIERIES COMPANY
TERRE HAUTE, INDIANA

What's your problem?

The statement above comes from Mr. D. W. Aten, vice-president of Maumee Collieries Company. Concerning his company's successful operation of several large strip pit mines in Central Indiana, Mr. Aten reports:

"We have a variety of equipment from light cars and trucks up to 25-ton dump trucks, 40-ton tractor trailer dump units, and heavy tractor bulldozers. These units work the year around, and in all types of weather. Under these conditions our equipment must be able to take punishment. Mr. Joe Burcham, our Haulage Superintendent, reports that STANOLUBE HD-M Motor Oil has protected our engines under these rugged operating conditions, and that our engines have remained clean and given trouble-free operation. These have been important factors in serving our customers' coal needs by enabling us to keep production up and maintenance costs at a minimum."

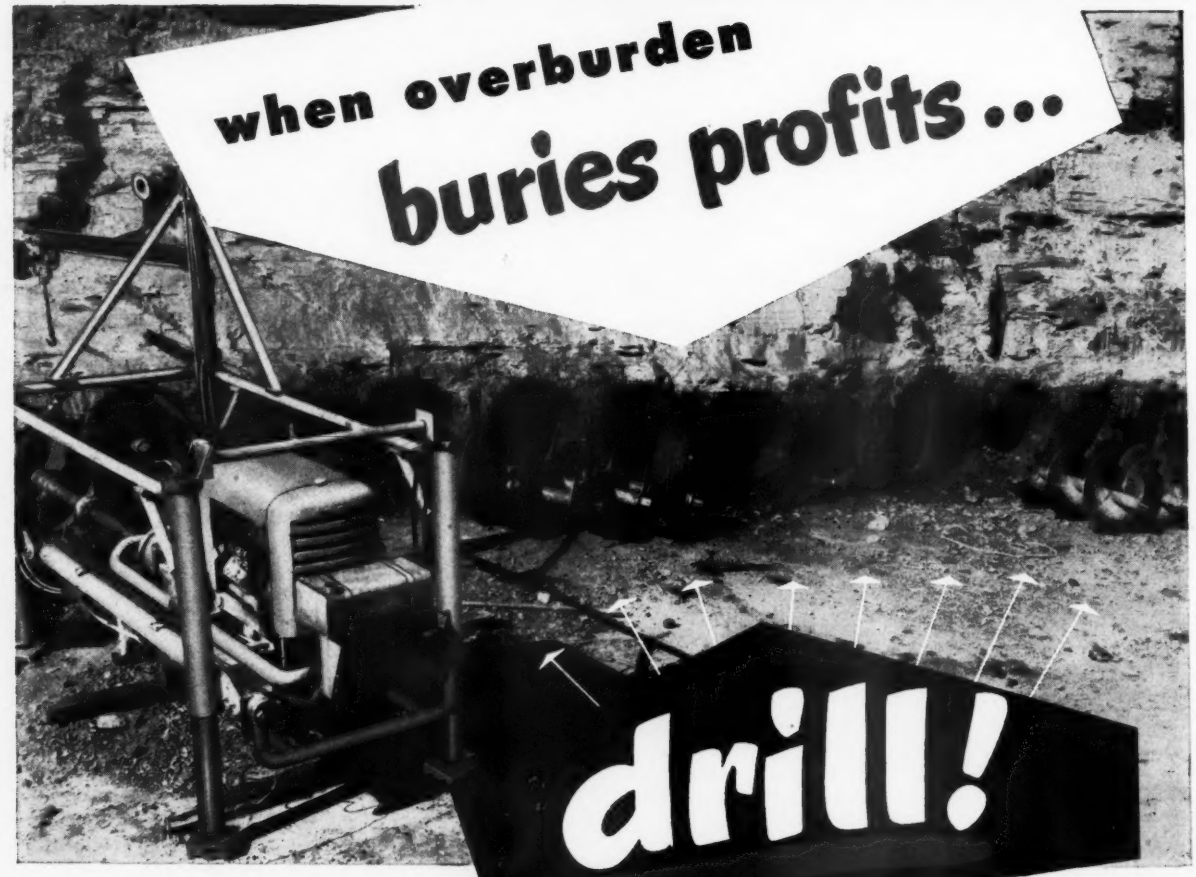
Make the experience of the Maumee Collieries Company the basis for discussing your lubrication needs with your Standard Oil lubrication specialist. This man is located near your mine and has the products and the lubrication engineering "know-how" to help you get more effective lubrication of your mining equipment. For his services, phone your local Standard Oil office. Or, write: Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

STANOLUBE HD-M
REG. U. S. PAT. OFF.
Motor Oil

R. E. Murnahan, of Standard Oil's Evansville, Indiana, office, has worked closely with the Maumee Collieries Company to help them obtain maximum benefits from STANOLUBE HD-M Motor Oil and other Standard Oil products.

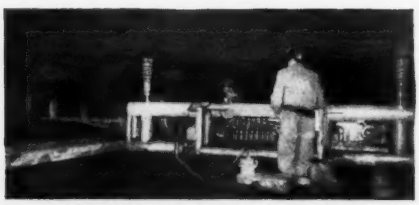
R. E. Murnahan is one of a corps of Standard Oil lubrication specialists located throughout the Midwest. One of these men serves your immediate area. Because of his special training and wide experience, he is thoroughly familiar with the lubrication needs of your mining equipment. You can reach him quickly and easily by phoning your local Standard Oil office.

STANDARD OIL COMPANY STANDARD *(Indiana)*



CARDOX Surface AUGER MINER

brings "dead" strip mines back to life . . .



CARDOX Underground AugerMiner

The practical answer for mines where seams or poor roof conditions make conventional mining unprofitable or unsafe. Write for Bulletin.

With a CARDOX Surface AugerMiner you can drill back 10 to 120 feet into coal seams buried by excessive overburden. The cost of salvaging this coal is normally only a fraction of that of the original working by conventional methods. The coal you left behind may be your highest profit tonnage!

CARDOX AugerMiners can be trucked or towed on their detachable wheels to any exposed face of coal. They are self-positioning to the height of the seam. Driven by a rugged 145 H.P. engine, augers up to 36 inches in diameter drill out clean, pure coal, ready for mechanical loading into trucks. Six-foot auger-sections are easily added or removed by the built-in retriever. Directional control keeps the auger boring into the best part of the seam, away from rock and shale.

Ask your CARDOX Representative for the Auger-Miner profit story. Or write for our AugerMiner bulletin.

CARDOX CORPORATION • BELL BUILDING • CHICAGO 1, ILLINOIS

WAREHOUSES

Harper, West Virginia
Phone: Beckley 4812

307 Northwest Fifth St.
Evansville, Indiana
Phone: Evansville 2-8944

Benton, Illinois
Phone: Benton 625

Box 427
Library, Pennsylvania
Phone: Library, Colonial 3-6910

Camden-on-Gauley, W. Va.
Phone: Camden-on-Gauley 2181
P. O. Box No. 1

St. Clairsville, Ohio
Phone: St. Clairsville 619

Louisville, Colorado
Phone: Louisville 234

Route 2, Box 99
Pikeville, Kentucky
Phone: Robinson Creek 5

Ottumwa, Iowa
Phone: Ottumwa 51

____ and a little child shall lead them

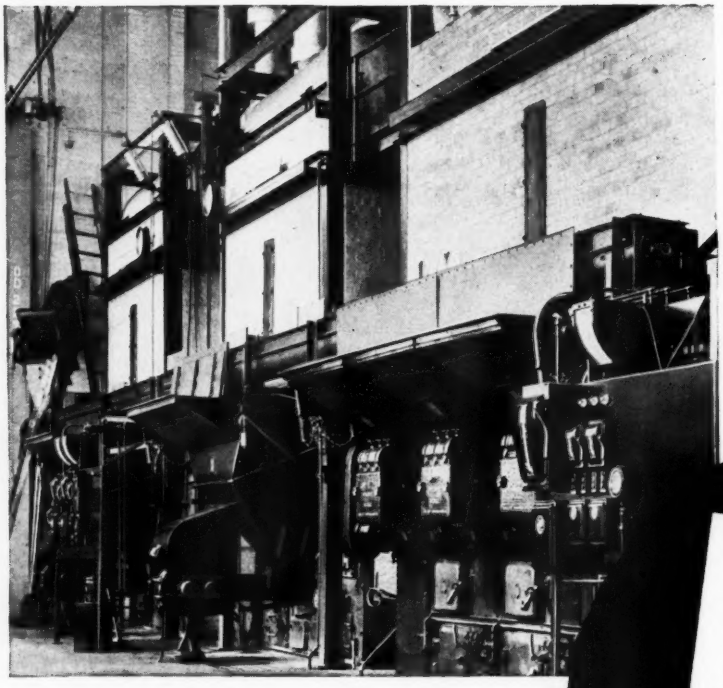
—Isaiah 11, Verse 6

The true spirit of this glorious Christmas Season is revealed
in the natural joy and simple faith of little children.

In the midst of rejoicing and reunion let us join with them
to light the way to better fellowship and understanding among all men.

AMERICAN CAR AND FOUNDRY COMPANY

WHY EUCLID SWITCHED TO COAL!



"We cut costs and provided our expanding plant with a flexible heating system by burning coal instead of gas,"

says D. L. Lawrence, Plant Engineer
The Euclid Road Machinery Co.
Cleveland, Ohio

"Upon expanding our St. Clair Plant, we found we could save money by replacing our gas-fired heating system with a modern coal-burning installation. After we ... plant again doubled ... boilers shown ... all our ...

What does it cost you to operate your steam plant
Chances are that, unless you've modernized in the past few years, you could reduce that cost substantial with modern, bituminous coal-burning equipment.

Modern combustion equipment can give you 10% to 40% more steam from a ton of coal. Up-to-date coal and ash handling equipment can cut your labor costs and provide you with a clean, convenient, dust-free operation.

And with bituminous coal, you will continue to enjoy these advantages for years and years.

TO HELP SELL COAL...

BCI Advertises to the Industrial, Commercial and Institutional Markets.

Each month, full-page messages like the one shown here—featuring either "off-track" or "on-track" installations—appear in the pages of *Business Week*, *Nation's Business* and a carefully selected group of power journals and trade magazines.

COAL ... **all fuels.** ... **world.**

COAL is the most stable of

COAL is the safest fuel to store and use.

COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

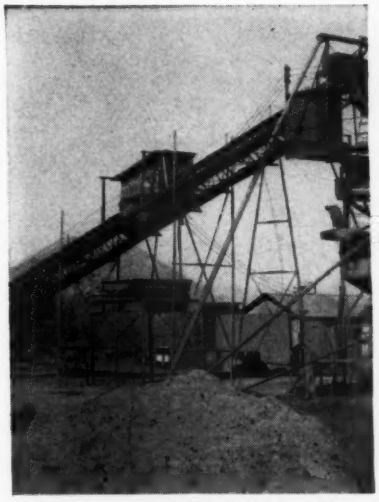
BITUMINOUS COAL INSTITUTE
A Department of National Coal Association
Southern Building, Washington 5, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

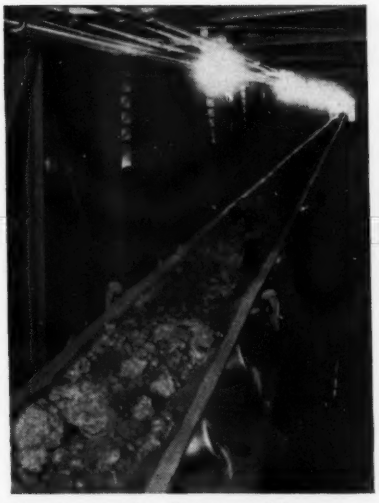
YOU CAN COUNT ON COAL!

For long-lived, heavy-duty conveyors . . .

IT'S TIMKEN® . . . AND TIMKEN . . .



This Pioneer Washing Plant handles an average of 70 yards of sand and gravel an hour. Conveyor idlers are equipped with Timken bearings—one reason why the plant still has the same conveyor belt after 5 years' operation!



Here's a 337-foot Bartlett and Snow conveyor carrying iron ore sinter at the rate of 150 tons an hour. Timken bearings on conveyor idlers reduce friction, assure long life, reduce belt wear.

Tempered moulding sand—50 tons of it an hour—rides at the speed of 125 feet a minute on this Rex Idler Installation in a foundry. Conveyor belt is 24 inches wide. Idlers are equipped with Timken bearings.

AND TIMKEN AGAIN!

AND HERE ARE 6 BIG REASONS WHY:

1. **THOROUGHLY PROVED.** The Timken® bearing is the only tapered roller bearing proved by 15 years or more of service in heavy-duty conveyor installations using the popular dead shaft construction.

2. **EXTRA CAPACITY.** Line contact between rollers and races gives Timken bearings high load capacity. And by using Timken bearing sizes that are mass produced for the automotive industry, you get extra capacity bearings that actually cost you *less* than the smaller sizes you'd normally use.

3. **LONG-LIFE LUBRICATION.** Nor just lubricated for "life", but lubricated yearly, or as conditions require, to insure *long* life. Fresh lubricant ends any chance of gummy, sticky, jammed bearings.

4. **LONGER ROLLER AND BELT LIFE.** Less sliding and scuffing between idlers and belt.

5. **FRICTION MINIMIZED.** Timken bearings' true rolling motion and extremely smooth surface finish practically eliminate friction.

6. **MAINTENANCE REDUCED.** Long life and dependable performance of Timken tapered roller bearings cut maintenance to a minimum.

Remember "Timken" is not a bearing type. It is a trademark applying to bearings made by The Timken Roller Bearing Company. Always insist on Timken bearings in the conveyors you build or buy. The Timken Roller Bearing Company, Canton 6, Ohio. Cable address: "TIMROSCO".

Wherever the going's tough industry turns to

TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Typical application of Timken bearings for conveyor idlers.

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▱ BEARING TAKES RADIAL ↓ AND THRUST → ← LOADS OR ANY COMBINATION

Decline Conveyor On the

HEWITT-ROBINS INCORPORATED

HEWITT-ROBINS

EXECUTIVE OFFICES, STAMFORD, CONNECTICUT

Job for Over 24 Years

EQUIPMENT: Hewitt-Robins Decline Conveyor.

LOCATION: Reitz Coal Company, Mine #5, Windber, Pennsylvania.

MATERIAL HANDLED: 18" maximum size, r.o.m. lump coal.

PERFORMANCE: Probably the first declining belt conveyor to be placed in service, this unit was designed to handle bituminous coal at the rate of 100 T.P.H., down a decline of 112'-0", at a speed of 110' F.P.M.

RESULTS: Installed in 1925 this Hewitt-Robins belt conveyor provided over 24 years of dependable, trouble-free service. The original Hewitt-Robins belt did not need replacement until 1949; the original machinery is still in operation.

Engineering Data

LENGTH OF CONVEYOR: 710' center to center from end pullies.

WIDTH OF BELT: 36"

DECLINE OF CONVEYOR: 112' . . . Belt Conveyor hugs the ground surface, in its travel.

CAPACITY: 145 T.P.H.

CHECK FOR INFORMATION ABOUT THESE JOB-TESTED PRODUCTS FOR YOUR OPERATION

CONVEYORS:
- ☐ —Belt
- ☐ —Dock
- ☐ —Mine
- ☐ —Shuttle
- ☐ —Slope
- ☐ —Vibrating
- ☐ —Fixed Tripper Shuttle

BELTING:
- *☐ —Elevator
- *☐ —General
- *☐ —Hot Materials
- *☐ —Raynile®
- *☐ —Steel Wrapper
- *☐ —Transmission
- ☐ —Woven Wire

- ☐ BUCKET ELEVATORS
- ☐ IDLERS

SCREEN CLOTH:
- ☐ —Electrically Heated
- ☐ —General

VIBRATING SCREENS:
- ☐ —Dewaterizers
- ☐ —General
- ☐ —Heavy-Duty Scalpers
- ☐ —Heavy Media

HOSE:
- *☐ —Acid
- *☐ —Air
- *☐ —Air Drill
- *☐ —Fire
- *☐ —Pinch Valve
- *☐ —Servall®
- *☐ —Steam
- *☐ —Twin-Weld®
- *☐ —Water
- *☐ —Water Suction
- *☐ —Flexible Rubber Pipe

- ☐ MECHANICAL FEEDERS
- ☐ STACKERS
- ☐ CAR SHAKEOUTS
- ☐ TRIPPERS
- ☐ BELT CLEANERS
- *☐ GROOVED PULLEY LAGGING
- ☐ CRUSHERS
- ☐ PICKING TABLES
- ☐ LOADING BOOMS
- ☐ RUBBERLOKT® BRUSHES
- ☐ MOLDED RUBBER PRODUCTS
- ☐ DESIGN AND CONSTRUCTION OF COMPLETE MATERIALS HANDLING SYSTEMS

*For immediate information about these industrial rubber products, call your Hewitt Rubber Distributor (See "Rubber Products," Classified Phone Book.)

Hewitt-Robins Incorporated
666 Glenbrook Road
Stamford, Connecticut

NAME _____

TITLE & COMPANY _____

STREET ADDRESS _____

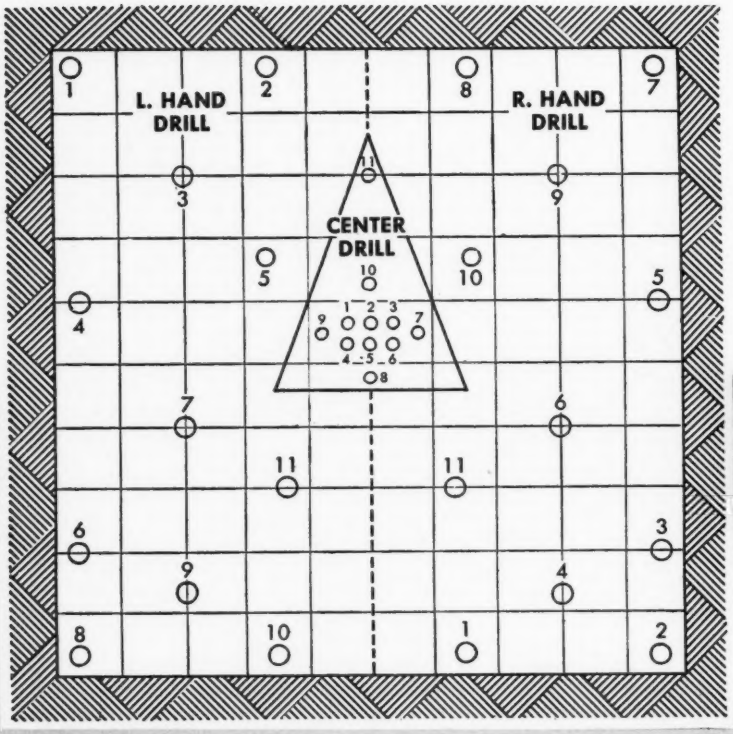
CITY _____ PO ZONE _____ STATE _____ 1182

INCORPORATED

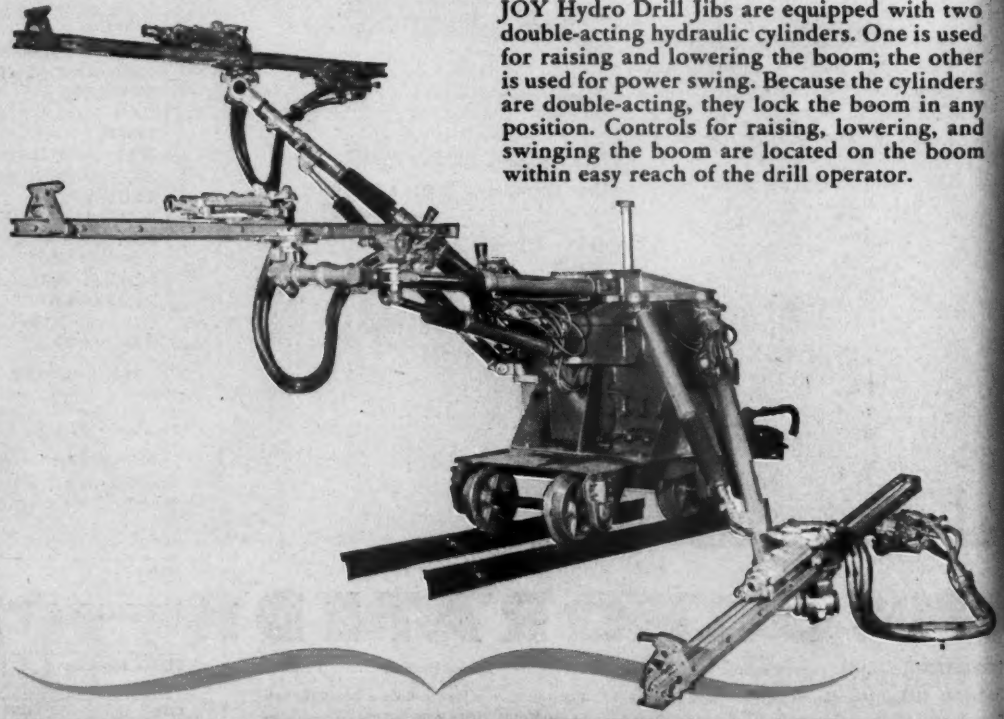
DOMESTIC DIVISIONS: Hewitt Rubber • Robins Conveyors • Robins Engineers • Restfoam
FOREIGN SUBSIDIARIES: Hewitt-Robins (Canada) Ltd., Montreal • Hewitt-Robins Internationale, Paris, France • Robins Conveyors (S. A.) Ltd., Johannesburg • EXPORT DEPARTMENT: New York City.

"DRILL OUT THIS ROUND"

said the Joy Engineer . .



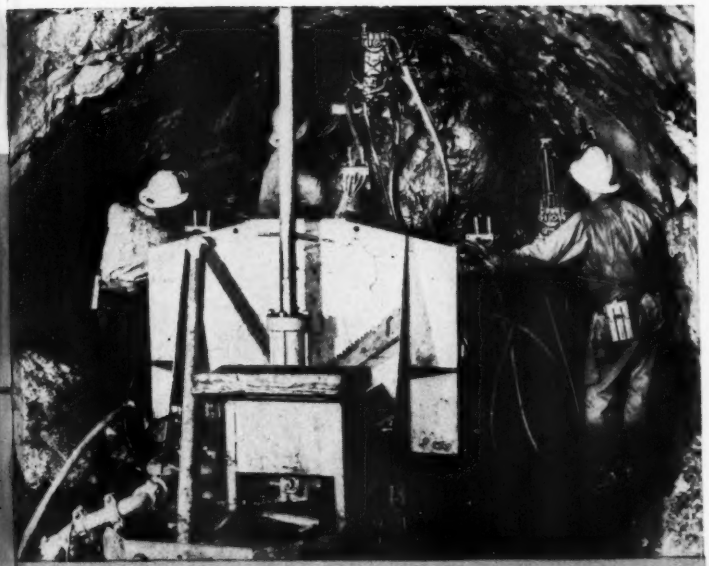
JOY Hydro Drill Jibs are equipped with two double-acting hydraulic cylinders. One is used for raising and lowering the boom; the other is used for power swing. Because the cylinders are double-acting, they lock the boom in any position. Controls for raising, lowering, and swinging the boom are located on the boom within easy reach of the drill operator.



MAXIMUM VERTICAL RANGE WITH VARIOUS LENGTH BOOMS: 10 to 14 FEET

MAXIMUM LATERAL RANGE WITH VARIOUS LENGTH BOOMS: 18 to 28 FEET

"IN RECORD TIME and WITH LESS EFFORT with JOY HYDRO DRILL JIBS"



On the job in a heading: a JOY Jib Jumbo mounting three Hydro Drill Jibs with JOY T-300 drifters.

JOY builds a complete line of Jib Jumbos and Drill-mobiles. Above: a twin-boom JOY Drillmobile, rubber-tired and self-propelled for quick, easy mobility.

The recommendation above was made by one of Joy's drill mechanization specialists. He made it to a mining company which is now a satisfied user of the equipment recommended: four Joy Jib Jumbos (see facing page) each mounting three Joy T-300 Drifters on LW-6A long chain feeds. He went on to say—

"The LW 6A feed, easily supported by the Hydro Drill Jib, has an overall travel of 8 feet with a steel change of 6 feet. Thus, the proposed round can be drilled with one length of steel."

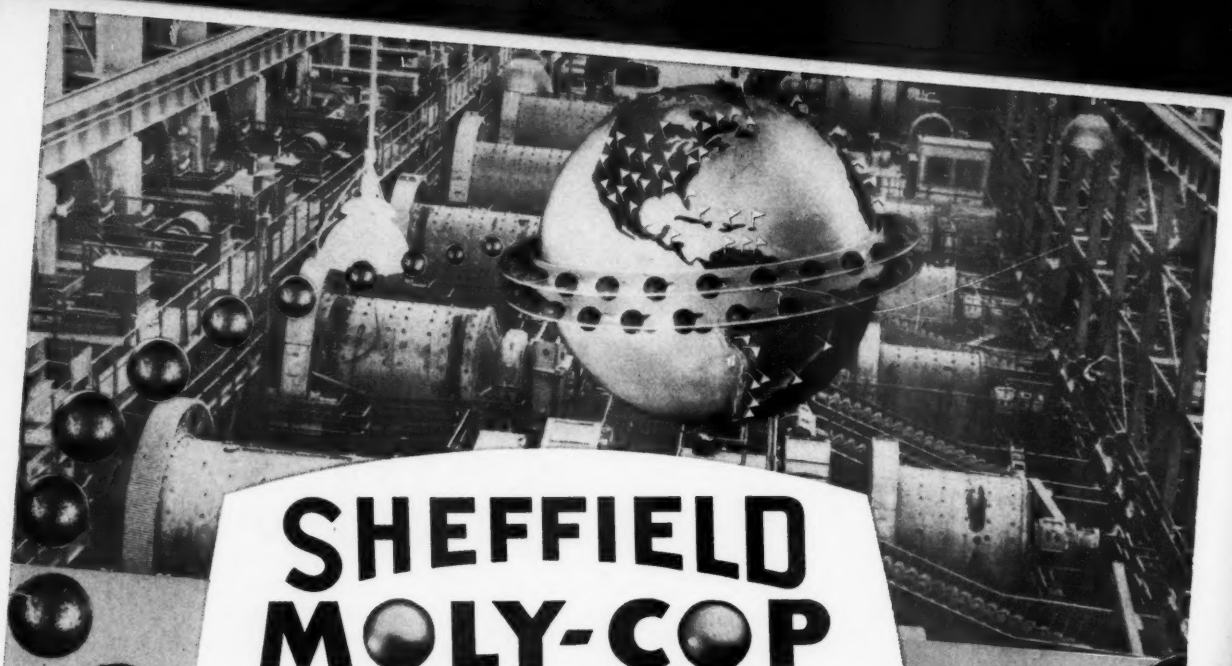
He then proposed and fully explained a drilling pattern (again see facing page) for a 10′ x 10′ round, showing the location of the eleven holes to be drilled by each one of the three jib-mounted drills. Basically, the plan provided for the least interference, and the maximum amount of drilling without dumping or swinging the drills. The holes for each drill were numbered so that the spreads between gave the runners plenty of working room. He closed by saying—

"The purpose of this proposal is to describe the many advantages of Joy fully automatic Hydro Drill Jibs. Joy pioneered the hydraulic drill jib and is still maintaining the lead in the design of this type of rig. We are keeping ahead with sound, practical improvements, and today believe we produce the finest drilling equipment available."

● Why not let a Joy drill mechanization specialist look over your problem and solve it the way he did this one? *Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa. In Canada: Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*

Consult a Joy Engineer

JOY



SHEFFIELD MOLY-COP

TRADEMARK REG.

COPPER-MOLYBDENUM-ALLOY

Grinding Balls

Used and Proved All Around the World

Measure the price of your grinding balls in terms of highest possible production and the lowest cost per ton of material ground

Do this and you will join the ranks of mines, mills and cement plants, including some of the world's largest concentrators, who have standardized on Moly-Cop balls.

The Sheffield alloy, hot rolled, hot forged, slow cooled, reheated, sized and quenched—all by means of automatically controlled equipment—produces fine-grained, harder, tougher balls that wear longer and hold their spherical shape longer.

You benefit from lower ball costs per ton milled, fewer chargings, less handling and down time, greater grinding efficiency and reduced mill power consumption.

Sheffield engineers stand ready to prove the money savings advantages in your operation.

Export Representatives: ARMCO INTERNATIONAL CORPORATION, MIDDLETOWN, OHIO

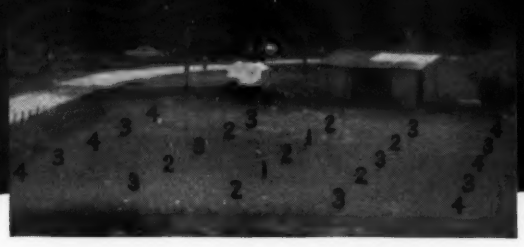
SHEFFIELD
STEEL
CORPORATION
HOUSTON KANSAS CITY
TULSA

SUBSIDIARY OF ARMCO STEEL CORPORATION

the inside story

Here's how ROCKMASTER® increases displacement

Final muck pile as seen from the road.



When the contractor or stripping operator says he wants a blast to produce increased displacement he means, "Well broken rock, piled up for easy digging" . . . the way it is in the large photo above. In this tight shot the rock was not thrown high, but it was thoroughly broken and dislocated from its original position.

The height of the final pile shows the increased displacement you can get with ROCKMASTER millisecond delays in an alternate pattern. When the blast is shot the first delays thoroughly stress the burden. Then at the instant of maximum stress, the next delays hit the burden with a churning action that twists and turns the rock. Without this double punch, the rock would tend to drop back into place. This would mean hard, expensive digging at the bottom of the pile even though the top rock might look well broken.

To see how you can profit by using the correct number of the sixteen ROCKMASTER millisecond delay electric blasting caps teamed with the ROCKMASTER system of explosives choice and loading methods, write for your copy of the 20-page ROCKMASTER booklet and a reprint of the paper "OVERBURDEN BLASTING TECHNIQUES."

ATLAS

ATLAS EXPLOSIVES

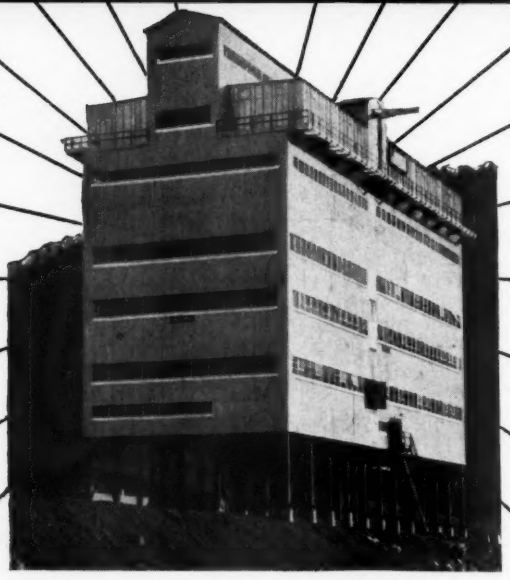
"Everything for Blasting"

ATLAS POWDER COMPANY, WILMINGTON 99, DELAWARE

Offices in principal cities

HOW POCAHONTAS FUEL COMPANY FOUND

21 GOOD ANSWERS TO The Dry Cleaning Problem



When Pocahontas Fuel Company was faced with the problem of converting the output of its Itmann Mine to a high quality metallurgical coal it consulted Roberts and Schaefer Company. Results of that profitable consultation are shown here: *one R&S-engineered-and-constructed preparation plant and twenty R&S Super-Airflow Dry Cleaning Units* . . . 21 good answers to a basic dry cleaning problem.

During its more than two years of operation producing premium metallurgical coal for a discerning market, the Itmann Mine Plant has been characterized by efficient operation and freedom from down-time for maintenance or repair.

Next time you have a coal preparation problem why not do as Pocahontas and others have done: consult Roberts and Schaefer Company, an organization that offers you all these advantages:

Complete engineering and construction facilities . . . capable of doing the whole job or any part of it . . . any time you are ready

Complete line of preparation machinery for dry cleaning or wet cleaning

ROBERTS and SCHAEFER COMPANY

130 N. Wells Street, Chicago 6, Illinois

1315 Henry W. Oliver Bldg.
PITTSBURGH 22, PA.

Guaranty Bank Bldg.
HUNTINGTON 10, W.VA.

254 West 54th Street
NEW YORK 19, N.Y.

Editorials

JOHN C. FOX, *Editor*

DECEMBER, 1953

Traffic and Trade

HAVE you ever thought how the problems of our economic system, including the mining industry, resemble the traffic problems of your community? Here is the free enterprise system in action. Each car may be compared to a small company operated by and for its owner. Each bus or streetcar is a larger corporation operated for the benefit of its stockholder-passengers.

Trade itself resembles a two-way street with opposing streams of traffic, each made up of local vehicles and those from out of town. Left without any rules, regulations or policing, these streams might flow without mishap, but more likely, there would be accidents and traffic snarls all along the way. With reasonable laws and proper policing, the traffic will move smoothly and all passengers will arrive safely at their destinations.

Our trade is a dynamic thing. It is a road that is constantly being widened and strengthened to carry increasing traffic burdens. When the improvements provide more room than local vehicles require, there is space available for traffic from out of town. But a sudden influx of extra, "foreign" traffic can and will choke up even the most modern street; cause increased casualties and generally disrupt the even flow on which the local citizens have come to depend.

Some cities have proposed allowing only vehicles with legitimate downtown business to enter the more crowded streets. Others plan to channel excess traffic away from congested areas and into those where there is room for it. Such projects are afforded public support and are pushed through to completion with the blessings of local taxpayers and businessmen alike.

During the past year some segments of our domestic mining industry have been forced off the road by an overly large influx of hit-and-run foreign traffic. One proposal for providing some regulation of this foreign traffic in the light of modern conditions, the Simpson Bill, was defeated in Congress. Meanwhile more and more "hometown" lead and zinc mining and coal mining companies are being squeezed out of the running. Their wreckage litters the wayside and their bruised and battered passengers must seek other means of transportation, or starve. In many cases the junk-dealer may get what is left of the company. Perhaps some of the wreckage can be repaired when the excessive imports of minerals such as lead, zinc and residual fuel oil have been brought under control.

It seems to us that some additional traffic rules are needed. We must limit the amount of extra traffic fed into our lanes of commerce. Unless something is done, and soon, our roads may be littered with the rubbage of wrecked private enterprises—first the little ones, later the larger producers—and when a crisis arises in which we need all their combined carrying power, we won't have it.

December Song

ANOTHER year has just about run its course. It will be remembered for the truce in Korea—an uneasy armistice at best, but at least the senseless slaughter on both sides is halted. Last year we looked hopefully toward this possibility. The closing days of this year may see the actual Korean Peace Conference under way.

Other hot spots—such as Trieste and Indo-China—appear to be cooling down a little too. Conferences in the offing among the principal powers might arrive at decisions which will bring us closer to an end of the "cold war" and an approach to peace in our times.

Production, to strengthen our country against aggression certainly adds to the national dollar income and through that to a general feeling of well-being. But production of goods to be blown up or shot away does not create national wealth. Rather it may contribute to the inflation which we must fear almost as much as attack from without.

Until we can be assured of a lasting peace, however, we must be prepared to devote a major portion of our earnings and production to the defense effort.

All Americans, and especially those of us in the mineral industries, must continue to contribute as fully in the forseeable future as we have in the past, to keep our country strong and ourselves and our friends safe from attack.

At such time as the crises may have passed and we can dedicate our plus-production and our know-how to the making of plowshares instead of swords, our civilization will move into a Golden Era such as the world has never seen. Let our December Song in 1953 then, be a fervent prayer for the guidance of our leaders, that they may take the right steps to bring us through these crises with honor to the threshold of this new Golden Age.

After miners have seen a demonstration, are assured of instruction and find they can earn more, they become ardent advocates of push feed drill

Push Feed Drilling in the Butte Mines

Tests Prove Versatility and Economy But Instruction and Supervision Are Necessary to Promote Miner Acceptance

By ROBERT L. SANDVIG
Research Engineer
Anaconda Copper Mining Company

PUSH feed drills were first tested in the Butte Mines in 1949, and because feed leg controls and mounting brackets were not satisfactory, they were rejected in favor of conventional stopers and drifters. However, manufacturers have placed later models on the market with graduated feed control valves, well balanced mounting brackets, improved light drills, and aluminum feed leg cylinders. The adoption of push feed drills in many large western mining operations in the last two years is primarily due to the facts that they can do the same drilling assignment as well as other heavier drills and are popular with miners because they are light and easy to handle. Hence, in April, 1952, an extensive testing program was undertaken by the Anaconda Copper Mining Co. to determine the applicability of push feed drills at Butte and other subsidiary operations.

Miner Fatigue Reduced

Perhaps the foremost advantage is reduction of the miners' output of physical energy. Once a miner has mastered the knack of operating a push feed drill, he prefers it to all others. After mucking and timbering all the forenoon, he is tired, so willingness to drill a round in the afternoon is substantially increased by the popular lightweight drill. This is emphasized by the fact that they not only make their rounds, but show a willingness to drill longer rounds. In multiple heading set-ups, such as undercuts, more rounds are made in a shift. With the Butte mines working deeper levels as time goes on, the push feed drill will contribute its share toward increasing productivity of miners as well as making their jobs more attractive.

An All-Purpose Drill

The push feed drill is an all purpose drill; it does as well or better than conventional drills in stopes, small drifts, certain raises, and in sinking. Drilling of parallel holes is the most important feature to be exploited from the push feed. This permits breaking of longer rounds with fewer holes and without disturbing the walls. Using stopers in Butte square set stopes, a survey shows that 3.8 cu ft per foot of hole is a good yield. With push feed drills, 6.3 cu ft are broken per foot of hole, and

averages of 13.0 cu ft per foot of hole are on record.

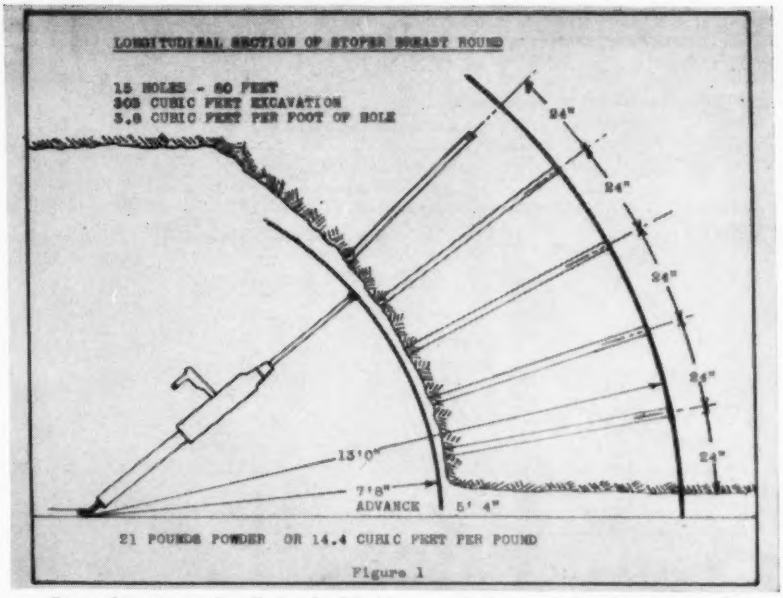
Assuming that the push feed drill requires as much manpower as the stoper, which it does not, a standard push feed stope round, making room for a lead set of timber, saves 32 ft of hole, 40 percent less than the stoper round. Correspondingly, powder consumption is proportionally reduced. It was quickly discovered that the horizontal, parallel holes produced such a mechanical advantage over the fan pattern stoper holes that even with increased burden, lower strength powders will do as well as the traditional 45 percent. Powder consumption can be and often is cut another 20 percent for a net of 60 percent less powder in stopes.

The amount of breaking possible in a Butte square set slot or vertical slice stope has always been governed by how much ground can be opened up by a blast and left standing until the next shift comes in and timbers up. It is becoming increasingly evident that many of these stopes, particularly the vertical slice stopes, can be made more productive with push feeds. The 15 hole stoper round for a 5-ft 4-in. advance has always been a practical limit without timber. By use of the parallel holes, fewer holes, and lower strength powder, 10-ft 8-in. advances are being made regularly and the hanging wall holds up very well until timber is installed. Hence, the push feed drill round is now virtually standardized at 10 ft 8 in., and extensive study is being made toward applying the push feed to cut and fill methods using rock bolts to give temporary support to the hanging wall and back.

Rock bolting is advancing steadily in the Butte igneous rock, and its application is based upon the stabilized arch theory. The push feed drill is ideally suited for rock bolting in conjunction with the push feed mining operation.

Increase Undercut Advance

Initial push feed drill testing was undertaken in the undercuts, finger raises, and grizzly drifts of the Kelley mine, also known as the Greater Butte Project, where block caving is being used. The light weight, easily portable push feeds were readily accepted for that work. Advances of 7.0 ft per man-shift in the undercut crosscuts, 7- by 5-ft cross-sections, are common. Pillars between the crosscuts average 16 ft, and with the push feed drills, two miners frequently drill 100 holes 8 ft deep, one drill to a man, for 800 ft in a shift to accomplish rapid pillar extraction. The long steel is particularly well accepted by undercut miners because by holing into a finger raise with every crosscut blast, the mucking job becomes quite simple. Fingers are brought up to the undercut elevation prior to advancing the crosscuts, and are alternately at 12- and 18-ft centers. The 11-ft and 16-ft steel are used often.



Stoper breast round pulled only 5-ft 4-in., required more holes, heavier powder

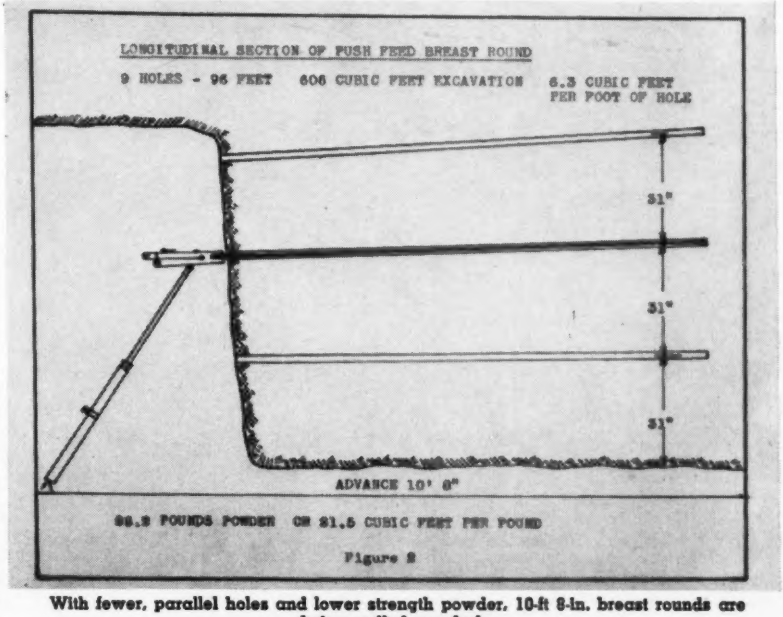
Make for Greater Safety

Finger raise advance with stopers was usually by 6- to 8-ft blasts. To get an 8-ft hole with a stoper, five changes of steel are required. Miners quickly saw the advantages of the 31-in. steel change over the 18-in. change, so with four changes of steel and a push feed drill, each man would drill an 11-ft round before lunch time and another after lunch to bring a finger raise up to elevation for each man-shift.

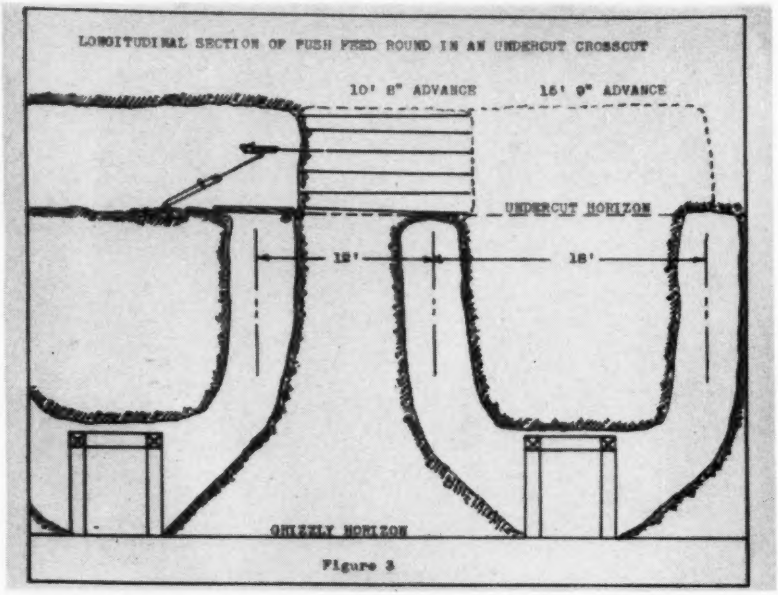
Using the push feed drills with 16-ft, 21-ft, and 25-ft steel, drilling of high packed finger raises without going into the finger has been proven a very practical means of getting them back into production.

Shaft Sinking Simplified

Shaft sinking in hard rock can be simplified by hanging the crowfoot of the push feed drill from a rock bolt, stull, or end plate, and using the air feed to increase the drilling speed of the sinker. The hand held sinker de-


LONGITUDINAL SECTION OF PUSH FEED BREAST ROUND
9 HOLES - 96 FEET 606 CUBIC FEET EXCAVATION 6.3 CUBIC FEET PER FOOT OF HOLE
31"
31"
31"
ADVANCE 10' 8"
98.2 POUNDS POWDER OR 21.5 CUBIC FEET PER POUND
Figure 2

With fewer, parallel holes and lower strength powder, 10-ft 8-in. breast rounds are being pulled regularly



Holing into a finger raise with every undercut round makes the mucking job simple

pends upon a man to force feed it, and a time study in Butte shows that the air feed increases the drilling speed by roughly 20 percent, in addition to reducing the fatigue of the driller.

Drilling Time Cut

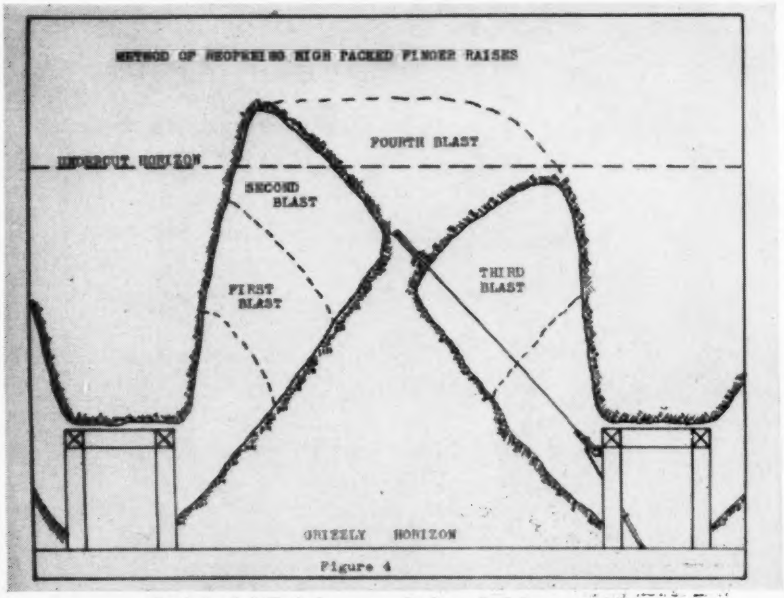
In early August, 1953, 7954 ft of push feed drilling time study data were on file from tests conducted since June, 1952. In the same time, comparative time study data were collected on 1579 ft of drilling with conventional drills. On the average, the push feed drill will complete a given footage of holes in 16 percent less time than a stoper. The competition with drifters depends upon the size of heading and depth of round to be drilled.

Two significant factors are determined from the recapitulation of a drilling time study. The minor factor is the traditional, inches per minute, and it is significant only in judging the performance of the drill. The major factor significant in comparing drilling methods is man-minutes per foot drilled. That is representative of the labor spent to attain a necessary footage of drill hole, and it is derived by dividing the total time spent in completing a round by the total footage in the round. With push feed drills, that figure varies from 0.52 in soft rock to 1.50 in very hard rock. The broad average for Butte ground is 1.00 man-minute per foot. A calculated sample analysis of a time study comparison between the stoper and push feed drill is given below on the basis of standard rounds.

Note that the stoper drills 20 percent faster than the push feed, but because the driller must change steel every 18 in., his drill is running only 54 percent of the over-all drilling time. With the slower push feed, a driller need not change steel at all to get the same depth of hole as the stoper, but since he has cut his drilling time 40 percent by eliminating six holes and 16 percent more by using the long steel change, thus keeping his drill running 84 percent of the time, he can break twice as much rock as the stoper man in approximately

AVERAGE STOPE GROUND

Type Drill	Man-Min./ Ft Hole	Drill Speed In./Min.	Drill Rod Lengths	Total Footage	No. Holes	Cu Ft	Total Time
Push feed	1.00	14.4	5 ft 10 in. 1st 11 ft 0 in. 2nd	96	9	606	96 min.
Stoper	1.16	17.3	3 ft 3 in. 1st 4 ft 9 in. 2nd 6 ft 0 in. 3rd	80	15	303	93 min.



Push feed drills help reopen high packed fingers safely

the same time spent in drilling. Actually, in stopes using push feed drills for the 10-ft 8-in. round, the miners report an hour and a half to make their nine hole round, which is about the same time they spent previously for their shorter stoper rounds.

In much of the Butte round, steel bits remain sharp up to 25 ft, so tungsten carbide is used only in abrasive quartz or unaltered quartz monzonite—then only because it is necessary to preserve that important principle in push feed drilling, namely, the long steel change.

Using steel bits in an unaltered quartz monzonite crosscut, collaring and finishing with an 8-ft 5-in. rod for a net depth of 8 ft, a push feed drill (2½-in. bore) averaged 8.9 in. per min for 36 holes at 80 psi. Overall drilling efficiency was 1.76 man-min per ft. Thirty-six bit changes were required. Using tungsten carbide bits in similar ground, same drill, same steel, and same pressure, drilling speed was increased to 11.2 in. per minute and over-all efficiency was 1.15 man-minutes per foot. In similar

ground and at the same air pressure, a 3½-in. bore drifter mounted on a pneumatic column bar using a 24-in. steel change averaged 18.5 in. per min and over-all drilling efficiency was 1.54, not counting the 18 min. required to set-up the column bar and mount the drill. Steel bits used with the drifter were ⅛ in. larger in diameter than those used with the push feed.

No Extra Equipment Needed

Ten push feed drills can be purchased for the price of one boom type drill carriage and the drill or drills it must mount. Likewise, either two or three push feed drills can be had for one bar mounted drill and its bar, clamps, chuck wrenches, etc.

To drill an 8-ft hole with a stoper requires five pieces of steel for a total of 31 linear ft of drill rods. One piece of steel 8 ft 5 in. will suffice for an 8-ft horizontal hole, while for vertical holes, using a 31-in. change, 17 ft 6 in. of drill rods are enough for the 8-ft hole. Further, the life of a drill rod used on the light machine is from three to ten times the life of a drill rod used on the heavier stopers and drifters.

Recapitulation of time study data from a large footage shows that conventional construction gives 36.4 percent higher drilling speed than with the tappet and straight shank. A recent development in collaring ⅞-in. hexagonal steel, namely, the "pear-shaped collar," has eliminated the desirability of using straight shanked steel, so this finding has only academic value. Likewise, time studies show that the ⅞-in. hexagonal steel will give from 10 to 30 percent higher drilling speeds than the ⅞-in. quarter octagon rods, using conventional construction. That is because greater rotation effort is required to overcome the greater drag of the Q. O. section.

QUARTZ MONZONITE CROSSCUT

Type of Drilling Method	Man-Min./ Ft Hole	Drill Speed In./Min.	Total Footage	No. Holes	Total Time For 8-ft Round
Push feed, steel bits	1.76	8.9	288	36	8 hr 27 min.
Bar mounted 3½-in. bore drifter, steel bits	1.54	18.5	288	36	7 hr 24 min.
Push feed, carbide	1.15	11.2	288	36	5 hr 31 min.

Using steel bits in softer, less abrasive rock, a push feed averaged 16.9 in. per min. for 23 holes eight ft deep. Efficiency was 0.92 man-minutes per foot. In the same ground and at the same air pressure, a 3½-in. bore drifter mounted on a single boom drill carriage averaged 27.3 in. per min. with efficiency at 0.89 man-minutes per foot. Not included in the over-all efficiency figure was the time required to move a mechanical loader out of the heading and move the drill carriage in. Preparing the drill carriage for drilling after being spotted by the motor required 7 min., while the moving usually requires 18 min., for a total of 25 min. However, the push feed is not considered competitive with the drill carriage for long rounds in large headings at this time because of height limitation and the need for larger diameter holes to take a heavier powder charge. For drift rounds 5 ft 4 in. deep, the push feed drills without carbide bits can do a better job of drilling in less time than either the bar mounted or drill carriage mounted heavy drifters, due to quick set-up time for the push feed.

Find Small Bits Slower

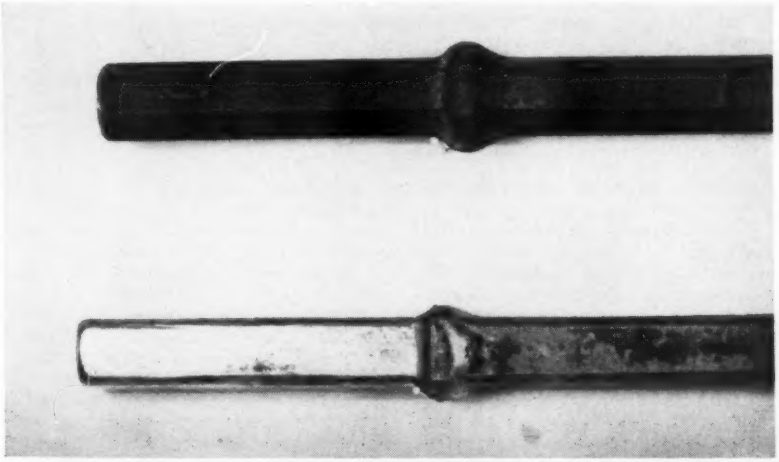
So long as a steel bit remains sharp enough to cut, it is faster than the carbide bits. Since most of the Butte ground is soft and contains much clay, use of steel bits will not only be cheaper but will be faster. Carbide care places an extra load on a supervisor, so in practice, supervisors do not ask for carbide bits unless the ground requires them; that is, when the ground is so hard or abrasive that the long changes cannot be made without carbide bits. They are certainly justified from an economic standpoint under those conditions because they make the difference of whether a 5-ft 4-in. or 10-ft 8-in. round will be made.

STEEL REQUIREMENTS FOR 8-FT HOLE

Stoper ⅞ Q. O.	Push Feed Vertical	Push Feed Horizontal
39 in. 1st	39 in. 1st	101 in. or 8 ft 5 in.
57 in. 2nd	70 in. 2nd	at cost of $4.15 for stock
75 in. 3rd	101 in. 3rd	
93 in. 4th		
111 in. 5th	210 in. or 17 ft 6 in. at cost of $8.65 for stock	
375 in. or 31 ft 3 in. at cost of $15.42 for stock		

Time Study Findings

Since straight shank drill rods have been standard in the Butte mines for many years, a study was conducted to determine the practicality of using tappet construction in the light drills.



Time studies showed ⅞-in. hexagonal steel gives 10 to 30 percent higher drilling speed than ⅞-in. Q.O. steel

Bit sizes between 1⅝-in. diam and 1⅜-in. diam all perform equally well. A 1¾-in. bit slows the push feed drill quite appreciably, while lower drilling speed results with the small bits of 1⁵⁄₁₆ in. and 1¼ in. diam. The apparent reason for this is that cuttings do not escape fast enough with the small bits.

Rotate on Downstroke

Plugging steel in the clay rich Butte rock has always been a problem to Butte miners. Since regulation of feed leg pressure is vital in efficient push feed drilling, upstroke rotation combined with good feed leg pressure did not work out. However, by dampening the foot pound blow of the drill and increasing the power and speed of rotation, by using downstroke rotation, drilling speed is substantially increased, correct feed pressure maintained, and the hazard of

(Continued on page 37)

Roof Bolt Recovery

Substantial Savings Are Realized by Using Roof Bolts Over and Over Again at Several Mid-Western Mines

By L. W. KELLY
Mining Engineer, Region VIII
U. S. Bureau of Mines

ROOF BOLTING was introduced into midwestern coal mines in February, 1947*, but it was not until April, 1951, that the recovery of the bolts was begun. Recovery was induced by the high cost of steel; however, when it became apparent that great numbers of steel roof bolts would continue to be installed in the mines of midwestern States, it was inevitable that sooner or later the recovery of roof bolts would become an important issue. Although the practice has not yet become widespread in the industry, the appreciable savings realized by some companies in recovering bolts foreshadows a rapid increase in this phase of coal mining.

Roof bolts have been used such a comparatively short time that their potentialities are not completely known. At persent, the only standard of comparison that exists consists of posts and crossbars. It has been considered arbitrarily that one bolt equals one post and a set of bolts is equivalent to one crossbar. Inasmuch as recovery of posts and crossbars is considered normal in mining operations, it is difficult to see why recovery of roof bolts should not also become standard mining practice.

Recounted here are the methods employed at four mines to recover about 204,000 roof bolts without a lost-time accident. It is hoped that the methods shown here may be of value to other companies contemplating roof-bolt recovery. This report was made possible by the generous cooperation of Kenneth Snarr, general manager, Miners Coal Co.; Ward Padgett, general superintendent, Bell & Zoller Coal Co.; J. W. McGregor, general superintendent, Kentucky Division, Bell & Zoller Coal Co.; Elmos Williams, superintendent, Murdock mine, and William Guiney, superintendent, Zeigler No. 3 mine, Bell & Zoller Coal Co.

General Information and Recovery Practices at Four Mines

Fies Mine

The Fies mine, Miners Coal Co., Madisonville, Hopkins County, Ky., is opened by a 210-ft shaft and an 825-ft slope to the Kentucky No. 11 coal bed, which averages 72 in. in thickness. The coal bed is virtually flat with a maximum cover of 250 ft. Room-and-pillar mining is used, and pillars are not extracted. Main entries are driven in sets of four, 14 ft wide on 60-ft centers, and room entries are driven in sets of three, 14 ft wide on 60-ft centers. Rooms are driven 22 to 25 ft wide on 45-ft centers. A total of 276 men is employed, and average daily production is 4500 tons of coal. All of the coal is broken with permissible explosives after the faces have been undercut to a depth of seven ft and loaded mechanically. Life of the mine is estimated at more than 30 years.

Top varies greatly from area to area. In general, the immediate roof is a fairly hard shale, known locally as "gob." It ranges from four to 10 in. in thickness, and above this is a stratum of limestone about four ft thick. In some places the limestone disappears, and its place is taken by hard, black shale. Elsewhere both limestone and shale disappear, and fire clay occurs over the "gob," which in turn is surmounted by the Kentucky No. 12 coal bed. The No. 12 coal bed in this mine has virtually no inherent strength.

The mine was opened about four years ago and was one of the first in Kentucky to use roof bolts. The roof has been extremely bad in some places. The company has tried about every combination of roof bolts, timber and roof bolts and timber alone, imaginable. The most hazardous roof conditions are caused by frequent slips. The slips here seem more difficult to support than in other mines nearby, operating in the same coal bed.

As a result of the many difficulties encountered in supporting the roof, mine officials adopted a plan of using roof bolts only where they could be seated in limestone. In other places, conventional timbering is used.

Because the distance from the top of the coal to the limestone varies so greatly, different lengths of bolts are used. These range from 18 to 72 in. long. Bolts are ¾ in. in diameter and are used with expansion shells and 6 by 6 by ⅜-in. steel plates. Bolt holes are drilled with stopers, and impact wrenches are used to tighten the nuts. Three bolts are used in a set, and the sets are spaced every five ft. It is impossible to give the exact number of roof bolts installed, but a conservative estimate would be about 400,000.

Two Men Recover 95,000 Bolts

Two men are used to recover bolts. When they enter a room, the first thing they do is to examine the roof carefully from room neck to face. This gives them an idea of the condition of the roof and determines how many and which roof bolts they can recover. There is no inflexible rule as to the number they must recover, and the judgment of these two men determines which ones will be recovered. They are under instructions to recover only those bolts that can be recovered without injury to themselves. Their first operation is to set two No. 9 screw jacks under the set of bolts nearest the face and two more under the next outby set, as shown in Fig. 1.

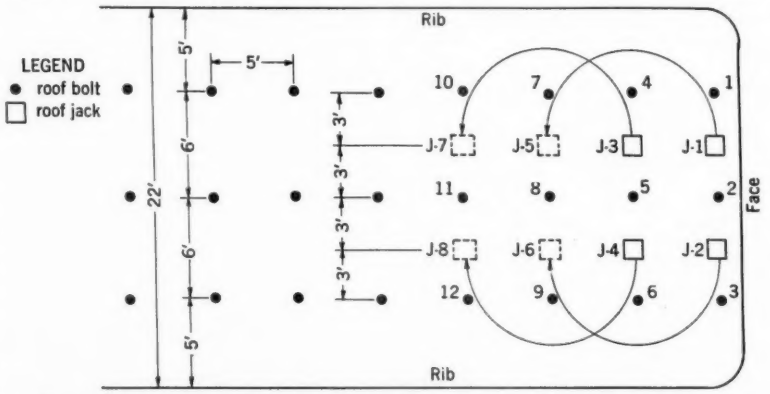


Fig. 1. Roof jacks protect recovery men at Fies mine, being leap-frogged back from the face as recovery progresses

* No. 7 mine, Consolidated Coal Co., Staunton, Macoupin County, Ill.

A 15-in. crescent wrench is used to loosen the nut. A short wrench is used because it is believed that if a bolt is so tight it cannot be loosened with a short wrench, the load may be resting on the bolt and recovery would be dangerous. When about six turns are made on the nut, the bolt is struck sharply with a hammer to drive the expansion plug up, freeing the shell. The bolt is then screwed out of the nut and recovered. A special hook—described later—is then inserted in the hole, and the shell withdrawn. About 90 percent of the expansion shells and plugs are recovered. When the bolts are recovered in the first set, the two jacks are moved back to the third set from the face, and the same procedure is repeated until all of the bolts that is possible to recover safely have been recovered. When a jack is removed, the practice is to loosen it a little and then listen. If the men do not hear anything, they remove the jack.

The men who do this work have been doing it since roof-bolt recovery was begun, and are capable and efficient. They have recovered approximately 95,000 bolts without an accident. The precautions that they take are reflected in the fact that they recover only about 60 percent of the bolts.

Two men recover approximately 271 bolts, plates, shells, and blocks in one shift. The cost of material recovered is given below:

One 30 by ¾-in. steel bolt	$0.36
One 6 by 6 by ¾-in. steel plate	.18
One expansion shell and plug	.30
One 3 by 5 by 30-in. wood plate	.25
Total value of one bolt assembly	$1.09

Thus, if two men at $18.08 a shift recover 271 bolts in one shift, a saving of $259.23 is indicated for one day's work.

Murdock Mine

The Murdock mine, Bell & Zoller Coal Co., is at Murdock, Douglas County, Ill. It is opened by two 218-ft shafts to an uncorrelated coal bed averaging 84 in. thick. The coal bed lies virtually flat and has a maximum cover of 230 ft. The room-and-pillar method of mining is followed, and pillars are not extracted. The main entries are driven in sets of five and six, cross entries in sets of three and six, and room entries in pairs. All entries are driven 14 ft wide on 50-ft centers and rooms are driven 20 ft wide on 50-ft centers. A total of 60 men is employed; of this number, 43 work in the mine. Average daily production is 1200 tons of coal. Coal is broken down with Airdox after the faces have been undercut to a depth of eight ft and loaded mechanically. The life of the mine is indefinite.

The immediate roof consists of 23 in. of hard, laminated (2-in.) gray shale; above this occur successively 36 in. of hard blue shale and over 72 in. of hard, laminated (4-in.) blue shale. There are very few slips, faults, horsebacks, or rolls. Before roof bolting was adopted, the roof was supported by means of steel and wooden crossbars, set on five-ft centers.

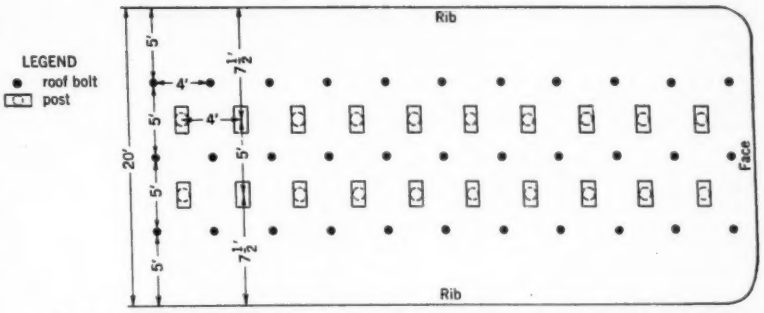


Fig. 2. At the Murdock mine, two rows of safety posts are used in 20-ft. rooms

In September, 1950, roof bolts were tried and proved successful. Since then their use has been expanded and approximately 50,000 bolts have been installed since the first experiment was performed. There have been no roof-bolt failures.

Bolts used are ¾-in. steel, five and six ft long, equipped with expansion shells. Bolt holes are drilled and the bolts seated by means of a shop-constructed drilling machine, which consists of two Dooley No. 474 electric drills mounted on a rubber-tired carriage. Kennametal bits are used. In entries two bolts, placed in the center and 4½ ft from either rib, are used in sets placed four ft apart. In rooms three bolts, equally spaced are used in sets on four-ft centers.

Save $142 Per Day

One man recovers the bolts. His first step is to deliver enough posts to the room neck to set two rows of posts up the center every four ft from room neck to face. (See Fig. 2.) The foreman then examines the place to see if there is any dangerous or loose roof rock, and to determine whether or not it is safe to recover the bolts. The man who is to recover the bolts is instructed by the foreman to keep himself safe at all times. If there is the least doubt in his mind about any bolt, he is to leave it. After the examination, the workman sets 10 pairs of posts from the face outby, as shown in Fig. 2. He then begins recovering bolts at the face and works back until he comes to the eighth pair of posts, when he sets 10 more pairs and continues recovering bolts and setting posts until he arrives at the room neck. Posts are not recovered.

In recovering roof bolts, the bolt is first unscrewed and removed; then an old bolt is screwed into the expansion plug and struck sharply with a hammer to loosen the plug and shell; this bolt is then removed, and the shell is recovered with the extracting hook shown in detail in Fig. 3. An old bolt is used to loosen the shell to keep from damaging the threads on the bolt that is to be used again. When the bolts have been recovered and removed to the underground shop, a mechanic brushes and oils the threads and replaces the palnuts. Some of the bolts have been used 30 times. Plugs and shells last indefinitely, but occasionally the threads on the bolts wear out.

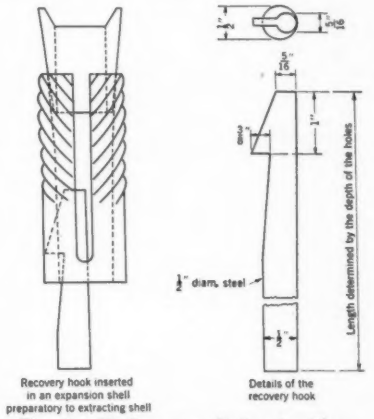

Recovery hook inserted in an expansion shell preparatory to extracting shell
Details of the recovery hook
Length determined by the depth of the holes

Fig. 3. Shells are pulled out with a recovery hook of the above design

Two lengths of bolts are recovered —five and six ft—and since this work was begun in September, 1951, approximately 34,000 bolts have been recovered. Roof in the mine is comparatively good; and this, combined with the fact that they timber adequately, allows them to recover about 90 percent of the bolts.

One man will recover an average of 100 bolts a day, and one complete bolt assembly is worth $1.87; consequently, the value of the material recovered by one man is $187.00 per day. From this, the cost of the posts ($24.00) and one man's wages ($21.00) must be deducted, leaving an indicated saving of $142.00 per day.

Zeigler No. 3 Mine

The Zeigler No. 3 mine, Bell & Zoller Coal Co., is at Zeigler, Franklin County, Ill. It is opened by two slopes, 320 and 528 ft long, to the Illinois No. 6 coal bed, which averages 108 in. in thickness. The coal bed lies

virtually flat and has a maximum cover of 160 ft. The room-and-pillar method of mining is followed, and pillars are not extracted. Entries are driven in sets of six, on 34-ft centers, and are 12 ft wide. Rooms are driven 18 to 24 ft wide on 50-ft centers. A total of 331 men is employed; of this number, 307 work underground. The average daily production is 4700 tons of coal, all loaded mechanically and broken down with Airdox after the faces have been undercut to a depth of 7½ ft. The life of the mine is estimated to be 14 years.

Immediate roof consists of 28 ft of soft, white, weak shale that disintegrates within 24 hours if it becomes wet. It is not laminated or stratified and has no lines of cleavage. When it fails, about two feet comes with the first fall, and the rest follows quickly to a stratum of hard, black shale 10 ft thick. This is considered to be the worst roof in the middle west. The conventional method of timbering consisted of installing 90-lb. steel crossbars about three ft apart.

Roof bolting was begun in 1950; and, after an experimental period, it was decided to use ¾-in. steel bolts 60 in. long, in sets of two in the entries and four in the rooms—the sets to be four ft apart. Bolts are used with expansion shells and 6 by 6 by ⅜-in. steel plates. In addition to the steel plates, a 1½ by 7 by 66-in. oak plank is used with each pair of bolts. A hole is drilled six in. from each end of the plank, and a bolt is inserted in each hole. Thus, one plank is used every 3½ ft in the entries and two every 3½ ft in the rooms. (See Fig. 4.) Holes are drilled, and the bolts are seated by means of shop-constructed, mobile drilling machines.

Men Pick Bolts to Recover

Two men recover bolts. Inasmuch as this is an exceedingly difficult roof to support, mine officials do not attempt to dictate which bolts to recover, and the recovery men are not given any certain number to recover in one shift. Upon entering a place to remove bolts, the men first examine the roof and determine in a general way the bolts they will try to recover. They start at the face to remove the bolts and in a normal place set three 16-ton capacity roof jacks, as shown in Fig. 4. When the selected bolts are removed they move the jacks back progressively. Sometimes only one bolt is removed from a board, and the board and the other bolt are left. Only about 15 percent of the bolts are recovered because of the bad roof.

Two men recover an average of 105 bolts in one day and since they started this work have recovered approximately 45,000 bolts without a lost-time accident. The motto of the company officials is "get the safe ones only."

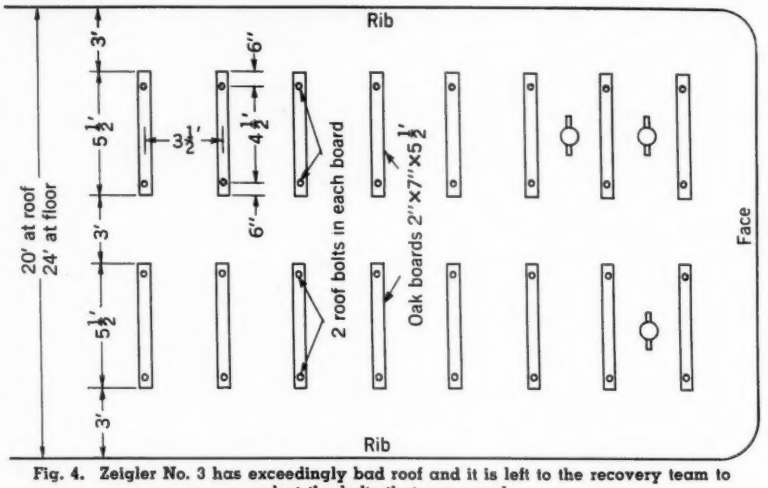


Fig. 4. Zeigler No. 3 has exceedingly bad roof and it is left to the recovery team to select the bolts that are sound

In order that an idea may be presented of the possible savings that result from recovery of roof bolts in this mine, the records of two representative months are given below:

Material Recovered in August, 1952	
2340 bolts @ $0.53	$1240.20
2340 plates @ $0.25	585.00
1708 expansion shells @ $0.29	495.32
1052 boards @ $0.38	399.76
Value of material recovered	$2720.28
Labor cost	749.15
Indicated savings	$1971.13
Material Recovered in November, 1952	
2674 bolts @ $0.53	$1417.22
2674 plates @ $0.25	668.50
2145 expansion shells @ $0.29	622.05
1171 boards @ $0.38	444.98
Value of material recovered	$3152.75
Labor cost	917.04
Indicated savings	$2235.71

overlain by about 72 in. of limestone; however, this may vary from area to area. Where roof bolts are not used, the roof is supported by means of posts or six-in. crossbars set at five-ft intervals.

Oriole Mine

The Oriole mine, Bell & Zoller Coal Co., is at Madisonville, Hopkins County, Ky. It is opened by one 140-ft shaft and two 510-ft slopes to the Kentucky No. 11 coal bed, which averages 75 in. in thickness. The coal bed lies virtually flat and has a maximum cover of 300 ft. Room-and-pillar mining is followed, and pillars are not extracted. Main entries are driven eight abreast, and the room entries are driven in sets of three. All entries are driven 14 ft wide on 50-ft centers and rooms, 22 ft wide on 40-ft centers. A total of 304 men is employed, of this number 247 work in the mine. The average daily production is 3800 tons of coal, all loaded mechanically and broken down with Airdox after the faces have been undercut to a depth of eight ft. Mine life is estimated to be 18 years.

The immediate roof consists of approximately 13 in. of hard black shale

Bolts used are ¾-in. steel, ranging in length from 18 to 48 in. and anchored with expansion shells. Steel plates 6 by 6 by ⅜-in. are used with the bolts. In the entries three bolts are installed in a set every four ft, and in rooms four are installed in a set every four ft. The first roof-bolt experimental installation was made in March, 1950. Since then about 60,000 bolts have been installed.

Roof-bolt recovery was begun in 1952; since that time approximately 30,000 bolts have been recovered without a lost-time accident. The method of recovery is shown in Fig. 5. A row of posts is set in the center of the room from the room neck to the face; two roof jacks are then set in the two inby sets of bolts. The bolts in the set nearest the face are recovered and the roof jacks moved back to the third set. This procedure is followed progressively until recovery is completed. Posts are allowed to remain in the room. A blueprint of

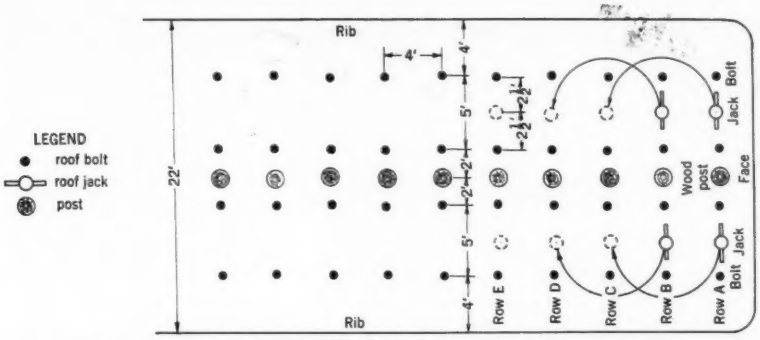


Fig. 5. **Both safety posts and roof jacks protect recovery men at Oriole**

Fig. 5 is provided for all members of the supervisory force and the men who are to recover the bolts. The following rules appear on the print:

1. Immediately after a bolted place has been worked out, set a row of wooden props as shown.
2. Set safety jacks as shown in Rows A and B.
3. Recover bolts in Row A.
4. Move jacks from Row A to Row C.
5. Recover bolts in Row B.
6. Move jacks from Row B to Row D—Repeat.

Note: Four safety jacks to be set when any bolts are to be recovered.

Recover 85 Percent of Bolts

Two men are used in this work, and they recover an average of 240 bolts a day. Their work is expedited by the fact that the company has provided them with a Baker-Raulang tractor and trailer with which to transport the recovered bolts to the room necks or shop. About 85 percent of the bolts are recovered.

Five different lengths of bolts are used, with correspondingly different costs, but for the purpose of this paper a conservative value of $0.357 a bolt is used. The cost of one roof-bolt assembly is considered to be as follows:

One ¾-in. steel bolt	$0.357
One expansion shell and plug	.24
One 6 by 6 by ⅜-in. steel plate	.206
Value of assembly	$0.803

Thus, if two men at $18.08 a shift recover 240 bolts, a total saving of $156.56 is indicated for a day's work.

Conclusion

Roof bolt recovery is rapidly becoming standard practice in the middle west, and we have tried to show some of the methods that have been employed for a year or more without any accidents. During the time when material was being assembled, roof-bolt recovery practices were observed in several other mines, but as their methods were similar to those described reference to them has been omitted. However, it can be said that approximately 400,000 roof bolts have been recovered in the last 18 months without a lost-time accident.

As roof-bolt recovery increases, some attempts may be made to recover the bolts without providing the proper protection for the men doing the work, in which case accidents are inevitable. It is hoped that the savings that can be made by recovering the bolts safely will convince any operators who are contemplating roof-bolt recovery, that adoption of similar safe methods is not only feasible but imperative.

Push Feed Drilling in the Butte Mines

(Continued from page 33)

plugging steel virtually eliminated. In the hard rock where carbide bits are necessary, upstroke rotation would give slightly higher drilling speed, but bit life is cut in half. Therefore, the use of downstroke rotation has been a big factor in the success of push feed drills at Butte. Likewise, the use of carbide bits will be much more economical because of downstroke rotation.

Choosing Drill

It is a tribute to the drill manufacturers that in two short years enormous strides have been made in drill designs along the push feed type. Choosing the best drill for the conditions under which they will be used is a very difficult problem. It cannot be solved prudently by any easy method. The criteria listed below are recognized at Butte as being primary considerations, but are not listed in order of importance.

(1) Handling Characteristics
   a. Weight of the drill
   b. Weight of the leg
   c. Method of mounting to give good balance
   d. Quality of feed control
   e. Location of feed control
   f. Ease of manipulating steel retainer and controls

(2) Durability — Determined from three mo. test

(3) Drilling Speed—Must be adequate to complete the standard round within the time the cycle provides.

(4) Effect of a Drill Upon Tungsten Carbide Bits

(5) Special Features
   a. Hole cleaning or blowing
   b. Adaptability for drilling vertical holes
   c. Detachability of the leg
   d. Auxiliary leg pressure control or release valve
   e. Telescopic leg (placing holes)
   f. New York Backhead

Operating Considerations

Getting miners to accept the push feed drills, modify their habits to an improved cycle, use the drill efficiently, and exploit its attributes may be considered a problem of push feed drilling. However, the gains to be realized make attacking that problem well worthwhile. In Butte, the use of demonstration and instruction is being employed quite successfully. Old time miners usually oppose the drill at first, but once they have seen a demonstration, find that an instructor will be on hand to help them through the first week, and that ultimately they will actually increase their earnings with less hard labor, they become ardent advocates of the new drill. Hence, the problem of miner acceptance will decrease as advocates are increased. However, Butte experience has taught that demonstration and instruction are as necessary in getting push feed drills into initial use as the bits and steel that go with them.

Much research work remains to be done before the final limitations of the push feed drilling potentials are determined. The studies conducted during the past year in Butte have given definite indications that more applications exist and that new concepts of mining practice will evolve which will incorporate the versatility of the push feed.

Steen's famous MiVida mine has already produced more than $1,000,000 worth of uranium ore

Opportunities in Uranium Mining

The Atomic Age Has Pushed Back the Horizon for Large and Small Miners Alike. Only the Surface Has Been Touched and Rich Rewards Await the Winning

By THOMAS E. GILLINGHAM
Chief, Physical Exploration Branch
Division of Raw Materials
Atomic Energy Commission

AS we enter this second decade of the Atomic Age, we have reason to hope that the awesome developments in nuclear science, which we have come to know, may somehow be fashioned for the good of mankind. Even now three nuclear power plants to drive submarines are in various stages of planning or construction; similar plants for surface ships and for airplanes are being considered; and many authorities predict that within ten years the first civilian-operated nuclear power plant for generating electricity will be an actuality. These remarkable developments and the still paramount military requirements bespeak a continuing and undiminished demand for uranium ore which the mining industry has been asked to meet.

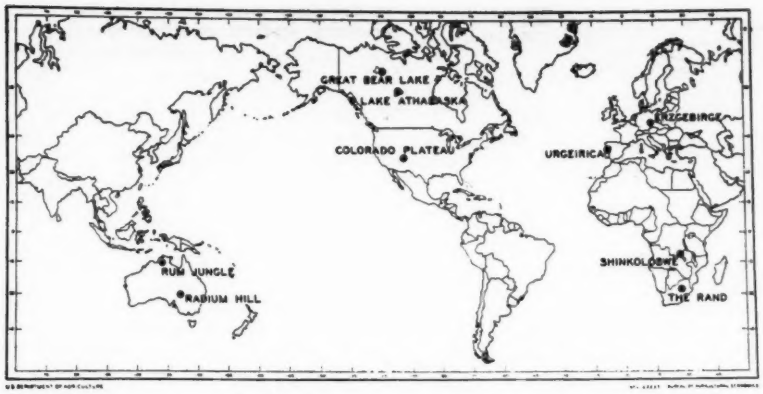
Bonuses An Incentive

The basic price schedules and the various incentive payments for domestic uranium ores have been established by the Commission in a series of circulars, the first of which was issued in April, 1948. The incentive payments for acceptable ores from the Colorado Plateau country are (1) premiums based on grades above 0.2 percent U_3O_8, (2) a development allowance of 50 cents per lb of U_3O_8 contained in the ore, and (3) an ore haulage allowance of six cents a ton mile, up to a maximum of $6. All three of these payments, as well as the base price of $3.50 per lb for ores averaging 0.2 percent U_3O_8 and higher, are guaranteed until April, 1962. There is also an initial production bonus, guaranteed until February 28, 1957, which is paid on the first 10,000 lb of U_3O_8 produced from a new domestic mine to help offset the cost of getting the mine started.

At this moment, there is no indication that the demand for uranium will lessen within the next ten years. The A. E. C. has a capital investment in plants of about four billion dollars, which is about equal to the entire plant investment of the U. S. Steel Corp. These A. E. C. plants have an enormous appetite for uranium source materials, and in the atomic energy program there is no substitute for uranium.

Assuming that the uranium price picture for the next decade will remain firm, what kinds of deposits will be mined, what are the chances for finding new ore, and what profits can be made from mining the ore?

For the next ten years most of the world's uranium will come from the types of deposits that now yield the bulk of the production. These are (1) the pitchblende-bearing veins and shear-zones, (2) the reefs of the Witwatersrand and the Orange Free State, and (3) the relatively flat-lying deposits of the Colorado Plateau type. There are other types of deposits, par-



IMPORTANT AREAS OF KNOWN URANIUM MINERALIZATION IN THE WORLD

U.S. ATOMIC ENERGY COMMISSION - DIVISION OF RAW MATERIALS JUNE 1953

ticularly the uraniferous phosphate formations and the black shales, which are potentially large producers; and there are still others, such as the pegmatitic deposits, which are of little more than academic interest. But in seeking opportunities in uranium mining in the Western Hemisphere, unless we are a large company interested in by-product uranium production from low grade sources, we come back inevitably to the first and third types mentioned above—the veins and shear zones and the Colorado Plateau type deposits. Let us consider these types briefly.

Veins and Shear Zones

Pitchblende, a variety of uraninite, is essentially an oxide of uranium. It may contain as much as 80 percent U_3O_8, the U_3O_8 being the unit purchased by the Commission. This mineral is black and very heavy, and a surprisingly small veinlet of it can be mined profitably under proper conditions.

It can be shown, for example, that a vertical veinlet averaging only ½ in. wide with a filling of pitchblende carrying 50 percent U_3O_8, can be diluted with waste to give a three-ft mining width and still yield ore averaging 1.46 percent U_3O_8. This ore would now be worth $140.50 per ton at the mine without initial production bonus (I.P.B.) or $242.70 per ton with that bonus. If the ore shoot were 100 ft long, there would be 26.68 tons per vertical foot, worth $3748 without I.P.B. or $6475 with I.P.B.

It can be shown similarly that a veinlet of the same pitchblende only ⅛ in. thick and mined three ft wide can yield ore averaging 0.36 percent U_3O_8, which is a good shipping grade, worth at the mine $31.20 per ton without I.P.B. or $56.40 per ton with I.P.B.

Buffam and Gillanders, two eminent Canadian geologists, have estimated that an orebody four ft wide and 400 ft long with an average grade of 0.25 percent U_3O_8 would have a value of about $5000 per vertical foot under the present Canadian price schedule.

These details illustrate why some single uranium mines, such as the Eldorado in Canada and the great Shinkolobwe in the Belgian Congo, each of which has remarkable concentrations of pitchblende, can yield such large percentages of the world's production.

Pitchblende need not occur in a solid veinlet to make ore. Disseminations, pods, or stringers of the mineral in a shear zone or other locus may constitute a valuable orebody. The fresh mineral can often be concentrated by gravity methods or by hand sorting. If indications of pitchblende are found, they should be followed downward to the fresh material, if feasible.

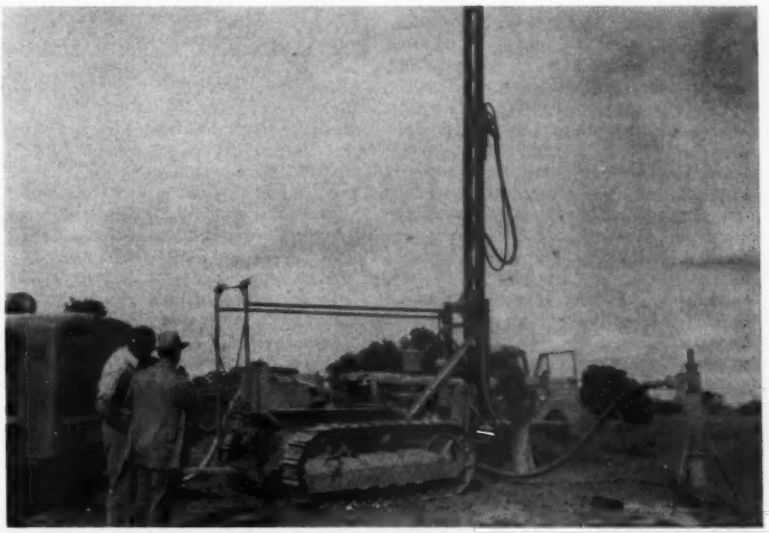
The Government has spent considerable sums to explore our pitchblende veins and has consistently encouraged American miners to comb the areas of the United States where pitchblende has been found, or is likely to be found, in the hope that, even if an American Shinkolobwe is not discovered, some good minable pitchblende veins will be brought to light.

Colorado Plateau Type

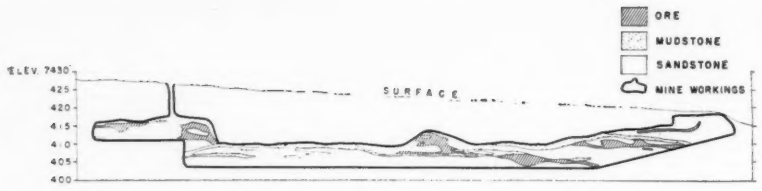
We come now to the uranium deposits of the Colorado Plateau type. Production from deposits of this category in several of our western States now ranks the United States in second place among the world's uranium producing countries.

The term "Colorado Plateau type" is used broadly, to include all those deposits, with the exception of the uraniferous phosphates and lignites, that occur in the relatively flat-lying sedimentary rocks of the Colorado Plateau and adjacent areas of our western States. The orebodies are typically flat-lying, like their enclosing beds, and irregular in plan, so that, in some respects, they resemble the Tri-State and the Illinois-Wisconsin lead-zinc deposits. Many of the Plateau orebodies produce valuable co-products and are often classified on the basis of these into roscoelite, carnotite and copper-uranium types. But from a mining viewpoint these various types are similar.

Individual Plateau orebodies range in size from a few tons up to several hundred thousand tons. Often a number of small, disconnected deposits can be mined as a unit by careful planning. The average grade of separate orebodies ranges from around 0.1 percent U_3O_8 to 1 percent, though a composite average would be closer to the lower figure. Ore thicknesses range from a few inches to as much as 15 ft, but the average would be less than five ft. Irregularities in plan may be equalled



Mounted percussion drill with sample collector is widely used for exploration drilling on Colorado Plateau



Ore often occurs in tabular bodies close to the surface

or exceeded in some deposits by vertical meanderings of the ore within the favorable bed. The ore may roll or twist, go up or down, or down and out in most disconcerting fashion. Such habits invoke the geologist's curiosity and the miner's profanity. But the good miner can follow his ore even under such circumstances; and, on the other hand, there are many thick tabular orebodies which do not present these problems. The ore is very rarely faulted, the ground generally stands well without much timber, and pumping is seldom a problem. Many orebodies can be opencast, others mined through adits or shallow inclines, and only a few of the larger deeper deposits require expensive vertical shafts. Already at least two vertical shafts are being sunk to depths below 500 ft.

The miner of the average Plateau deposit must watch the grade closely. The real profits are to be made from mining an average grade of 0.2 percent U_3O_8 or higher, unless the ore is abundant and thick or unless the mine is opencast. Ore averaging 0.20 percent U_3O_8 and 1.00 percent V_2O_5 commands, at mine head, a price of $22.20 per ton, including the vanadium payment and the development allowance, but not including the initial production bonus. In the average small mine there is not much profit in handling ore of lower grade.

The uranium miner does not have to worry about metallurgy. He is paid for the full content of U_3O_8 if the grade is above the minimum acceptable; for all his vanadium in most cases; and for his copper in excess of 1 percent at about smelter rates. Certain mills with acid circuits have difficulties with excessive lime, so a penalty for high lime is imposed in certain areas, but this is the only penalty. Zinc, lead, silver and gold are not paid for at existing domestic mills, but arrangements probably could be made to handle an ore carrying these metals and to pay for them if the tonnage were sufficiently large. The metallurgical problems, of which I assure you there are many in the uranium field, challenge the research metallurgist as he has rarely been challenged before.

Omitting many interesting details of geology and mining methods, here are a few points that bear on the opportunities in this remarkable uranium province.

(1) The orebodies, which most certainly formed after the rocks were laid down, are being found at more and more stratigraphic horizons. Already at least 14 different formations from Pennsylvania to Eocene age are known to be ore bearing and assuredly other formations will be added as exploration continues.

(2) While standstones and sandy conglomerates seem to be the most favorable loci for orebodies, some excellent deposits have been found in limestones and a few in shaly beds. It appears that relative, rather than absolute, permeability and other physical and chemical factors, such as the presence of carbon from buried wood, have controlled the ore deposition.

(3) The principal ore mineral on the Plateau has been, and still is, the soft, bright yellow, potassium uranium vanadate, called carnotite. It is an alteration product. As mines reach into the fresh rock behind the mesa rims and as drill holes penetrate to greater depths, we find more and more that these secondary products give way very gradually to black pitchblende and other primary minerals. In a paper, delivered at the A.I.M.E. meeting in Los Angeles last February, Dr. C. A. Rasor of the A. E. C. discussed the significance of these primary minerals. He concludes that the Plateau deposits are essentially hydrothermal in origin and that to date we have merely skimmed the surface of vast potentialities of primary ores.

(4) If the Plateau orebodies were deposited from hydrothermal solutions, structural features such as faults and folds, and the more intimate physico-chemical controls, expressed in sedimentary features, should be good guides to ore. The geologist seeking new orebodies on the Plateau should study the available structural maps, and pay particular attention to fault patterns and folds especially deep-seated paleo-fractures.

The A. E. C. Exploration Branch and the U. S. Geological Survey do all they can to assist the uranium miner to find new ore. In fiscal 1953, the A. E. C. and the Survey drilled 1,136,893 ft of hole on the Colorado Plateau alone. This drilling was mostly of the reconnaissance and widely-spaced exploratory sort. The Government's policy is to do no more than is needed to interest private capital in a particular area. The drilling is based on the best available geological indications, irrespective of the status of land ownership.

The Government offers assistance in other ways also. Loans for drilling and underground exploration are made by DMEA, and access roads into promising new uranium areas are built by the Bureau of Public Roads. Important deposits of any metal are not easy to find today, but large new deposits of uranium await discovery

This typical mine on the Colorado Plateau has tapped the Shinarump formation for its uranium ore

in the Colorado Plateau and adjacent areas. No new discoveries made near Lander in Fremont County, Wyo., since this article was written may prove the validity of this prediction.

U-Ore in Africa

A great pitchblende deposit in the Belgian Congo, near the Rhodesian border is the famous Shinkolobwe mine, still the world's premier producer after 30 years of steady operation. Lying in pre-Cambrian quartzites and dolomitic shales of the "Mine Series" of the Katanga, the orebodies are localized on cross faults and in breccia zones in an area where a westward trending fault system intersects the favorable formations. The veins contain some molybdenite, tourmaline, and monazite, but no intrusive rocks reach the surface within 25 kilometers of Shinkolobwe.

Farther south in the Transvaal and the Orange Free State, are the greatest potential uranium producers of the world — the famous gold mines of South Africa. Pitchblende is a coproduct with the gold and is obtained from the post-cyanidation slimes. Already three uranium recovery plants —West Rand Consolidated, Daggafontein and Blyvooruitzicht—are in operation; Western Reefs plant will be starting soon and at least a dozen additional plants are in various stages of construction or planning. Profits from uranium production, which already exceed expectations, may eventually equal the profits from gold.

Another potential uranium producer in Africa is the Rhodesian copper belt where pitchblende has been found along with the copper ore in at least one of the large mines.

In Portugal

In north-central Portugal, the Urgeirica and other mines are yielding a fair amount of good ore from pitchblende veins in a late Paleozoic granitic batholith. The ore shoots are similar to those of our own Marysvale, Utah, district.

Down Under

On the other side of the world in Australia are two known uranium areas—the old Radium Hill district in South Australia and the new Rum Jungle district in the Northern Territory. At Radium Hill, the uranium is in a rare iron-titanium mineral, davidite. The veins, which are three to six ft wide for the most part, lie in a gneissic host rock which has been intruded by dikes and plugs of granite and amphibolites. The ore is rather refractory, but the metallurgy has been solved and a treatment plant is being constructed.

The Rum Jungle deposits near Darwin are of the copper-uranium type. The principal uranium mineral, uraninite, is associated with pyrite and chalcopyrite, and is disseminated in broken and highly folded carbonaceous slates, which are part of a thick series of pre-Cambrian meta-sediments. The orebodies seem to be localized by cross-faults intersecting an axial shear, which is parallel to a great fault known as the Giants Reef Fault. The original discovery, made in 1949 by J. White is now being developed. Rum Jungle promises to be a very important producer of medium grade ore in the near future.

In North America

Coming now to North America, we find in Canada a number of important pitchblende vein and shear zone deposits. The most famous of these is the Eldorado mine at Great Bear Lake, N. W. T., where high-grade pitchblende ore has been mined for many years from a series of steeply dipping veins cutting metamorphosed sedimentary and volcanic rocks. Reserves are sufficient to keep this mine working for many more years.

In the Beaverlodge Area of northern Saskatchewan several large pitchblende deposits have been found, both in meta-sedimentary rocks and in granite-gneiss. Already a 500-tpd leach plant is being operated by Eldorado Mining and Refining Co. on ore from the Ace mine. An even larger plant may be constructed soon by private interests to treat ore from the already famous Gunnar deposit, which has been reported to contain at least 2,000,000 tons of ore, averaging about three lb of recoverable U_3O_8 per ton.

Almost every week during the prospecting season, new discoveries of uranium veins are being reported from Canada. There are probably 10,000 claims in good standing in the Athabaska district alone and around Beaverlodge the total investment in properties and equipment is estimated at $40,000,000. Expenditures on exploration and development there during 1953 are expected to be at least $8,000,000. The American prospector and mining entrepreneur are welcomed in Canada.

No pitchblende vein deposit quite like the Eldorado, the Ace, or the Gunnar has been found in this country, but we do have some excellent veins at Marysvale, Utah, and some smaller ones in the Boulder Batholith country of Montana, in the Coeur d'Alenes, in the Front Range of Colorado and at several places in the Southwest. Some of these deposits, especially the Vanadium Corp. of America mines at Marysvale, are producing good ore. It is interesting to note that pitchblende has been observed along with carnotite in sandy lenses in the Pottsville conglomerate, in deposits being explored by the Lehigh Coal and Navigation Co. at Mauch Chunk, Pa.

Other Sources

Colorado Plateau type deposits occur extensively in western Colorado and eastern Utah and somewhat less extensively in Arizona, New Mexico, Wyoming and South Dakota. The largest production has come from the so-called carnotite deposits in the Jurassic Morrison formation in the Uravan mineral belt, but the Morrison deposits are also found in the Lukachukai and Carrizo Mountains of Arizona, New Mexico and elsewhere. Important production of low uranium-high vanadium ores has come from the Jurassic Entrada sandstone near Rifle, Placerville and Rico, Colo.; and, in recent years, the carnotite and copper-uranium ores of the Triassic Shinarump-Chinle horizons farther to the west have added to the domestic supply.

The areas surrounding the Plateau proper have deposits in still other formations. Thus the Grants, N. M., area, which is proving to be a major district, has deposits in the Jurassic Todilto limestone and in the Cretaceous Dakota sandstone; the Black Hills area of South Dakota and Wyoming has orebodies in the Cretaceous Dakota and Lakota formations; and some promising deposits have been found recently in the Eocene Wasatch formation of east-central Wyoming.

There are also the low-grade sources, potential for the most part embodied in the great phosphate fields of Florida and the Northwest, and in the black marine shales of the East. Blockson Chemical Co. is already recovering by-product uranium on a small scale from phosphate rock, and additional plants should be in production soon. Much metallurgical research is being done on both the phosphates and the shales, but the opportunities in these lines entail more chemical than mining problems and are of interest only to the large companies.

There are many opportunities in this growing business of uranium mining. There are opportunities for the small miner, with very little capital, to mine small orebodies lying close to the surface; and there are opportunities for the large company to mine the larger and deeper orebodies or to participate in the production from low-grade sources. The opportunities are open and the Atomic Energy Commission stands ready to help in every way it can.

Head frames and smokestacks mark the length of Kalgoorlie's Golden Mile

Australia's Golden Mile

Story of What Is Reputed To Be "The Richest Square Mile on Earth"

By J. W. MORRIS
Adelaide, South Australia

THE perseverance of two prospectors, who in spite of scorn and ridicule persisted that gold in payable quantities existed deep beneath the surface, established the Golden Mile at Kalgoorlie. Today it is one of the leading gold belts of the world.

Not only did the prospectors establish the fact that gold existed at Kalgoorlie, but the first two mines to operate on the claims staked by them are still operating in their 60th year of production, their combined total annual yield was 250,215 fine oz.

The two men, Sam Pearce and W. G. Brookman, represented the Adelaide Prospecting Party, a small syndicate of 10 shares of £A15 (about $33.60) each, but within five years the various mining groups established at Kalgoorlie had a combined capital of £A30,000,000 or $67,200,000.

Pearce and Brookman had reached Kalgoorlie a few weeks after Paddy Hannan and his two Irish companions Thomas Flanagan and Dan Shea had made their rich strike on June 15, 1893, and after exploring the country staked out a 20-acre claim which they named Great Boulder.

Real Wealth in Lode Mines

Unlike Hannan whose success was shortlived because the gold was alluvial and shallow and became exhausted within two years, Pearce and Brookman were impressed with the prospects of a low ironstone ridge. Their faith was rewarded in 1895 when the first week's run of the Great Boulder yielded 250 oz.

Some weeks later the first crushings of the Lake View mine yielded 640 oz and shares which at that time were quoted at 3 shillings—jumped to 12 shillings—overnight and so the Golden Mile was introduced to the gold industry of the world.

Patrick Hannan first discovered gold at Kalgoorlie June 15, 1893

It is claimed today that the Golden Mile for its area is the richest square mile in the world because the lodes generally consist of nearly vertical zones of rock which are more or less continuous with the surrounding or "country" rock and payable gold is now being won at levels near 4000 ft.

The Golden Mile produces nearly 500,000 fine oz annually. At current prices, gold to the value of £A450,000,000 ($1,008,000,000) has been produced since the field started in 1893.

Today the Golden Mile is being worked by nine of the largest gold producing companies of West Australia and all are mining deep to follow the vertical Line of Lode and it is the principal gold mining center for the Commonwealth of Australia.

Mines Are Deep

Deepest mining is at the Lake View and Star where the Chaffers shaft is down to 4090 ft and the Ivanhoe shaft on the same company leases is at 3600 ft. The Hamilton, Edwards and Boulder shafts worked by the Great Boulder Proprietary are near 3000 ft.

The ore deposits worked on the field is a lode formation and in some cases quartz reefs of small size have been worked. Shearing action of some intensity has crushed and folded portions of the main rock masses in certain definite directions and produced well defined bands of lode formations in which the gold values occur.

Lodes vary from five ft to 30 ft in width and extend upwards or downwards for hundreds of feet carrying uniform and moderate gold values. There are a number of zones of special richness which are peculiar only to some mines as shoots.

The superior richness of the lode formations, and in particular the shoots, is largely due to the presence of various tellurides of gold and silver for which the Boulder belt is world renowned. Tellurides were first reported by A. G. Holroyd in 1896 when he discovered telluride of gold ore at Block 45.

Oxidized ores of the Boulder belt were of high value: Great Boulder from its first crushings yielded 40,000 oz from 8000 tons of ore; Lake View 15,000 oz from 5400 tons; Ivanhoe 6800 oz from 3500 tons; Brown Hill 2400 oz from 750 tons and Boulder Perserverance 7000 oz from 2100 tons. In the first four years on the field 112,000 tons of ore yielded 337,000 oz of gold.

Great Boulder Proprietary Gold Mines Ltd. has continued as a successful mining company since Sam Pearce staked the claim in 1893 and its first year of production yielded 26,663 oz of gold from 4291 tons of ore, an average of more than six oz to the ton.

The three principal leases of the Great Boulder holdings occur in quartz dolerite greenstone which is the most productive rock in the Kalgoorlie field. They are traversed by a composite belt of slate and porphyry known as the "Boulder Dike" which is actually a band of slate intruded by albite porphyry.

Average width of the dike is 200 ft: it strikes northwest and dips southwest at a steep angle where it gives an increasing area of quartz dolerite greenstone but with the exception of a northern extension of the main lode and two western branches of it the dike has not yet been proved to contain payable ore bodies.

Development of payable ore is by eight-ft by six-ft drifts on lode off eight-ft by seven-ft crosscuts. Level intervals are 150 ft vertically but in the older workings some 100 ft and 120-ft intervals were developed.

Ore Averages $9 Per Ton

Annual output totals 450,000 short tons and ore reserves of Great Boulder lodes are estimated at 2,121,200 short tons averaging 0.26 oz per ton.

Lake View and Star Ltd. holds 47 leases in the heart of the Golden Mile and about 132 mi of lateral development has been completed in exploration and development of 150 known lodes. Since 1910, the incorporation date, 28,122,050 short tons of ore have yielded 12,159,450 ozs of fine gold.

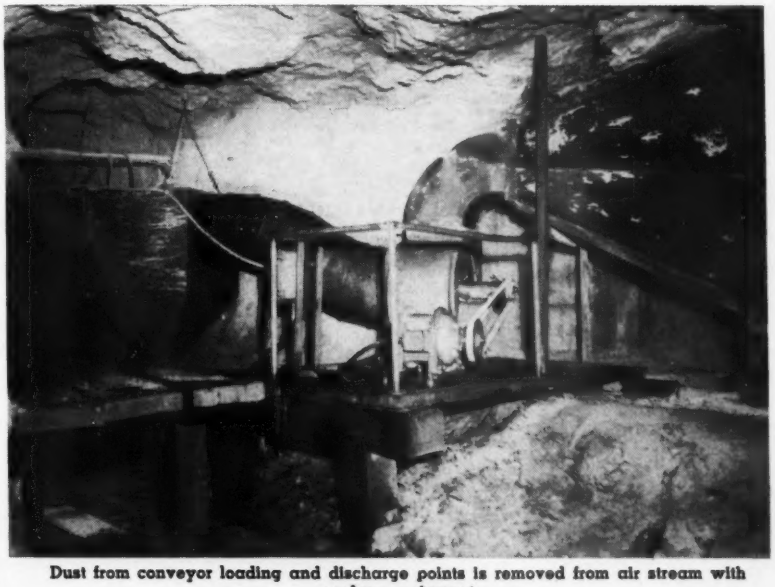
Discharge end of conveyor belt No. 7 level North Kalgurlie Mine

Productive lodes of Lake View and Star occur in dolerite greenstone but other profitable ore shoots have been found in calc schist (older greenstone) and porphyry and, in some locations, wholly in beds of slate which are associated with the porphyry.

At present 90 levels serviced by six main shafts are being worked and 29 electric locomotives operate underground hauling trains of five to ten 1¼-ton side dump cars. Ore reserves are estimated at 3,723,700 short tons averaging 0.236 oz per ton.

North Kalgurlie (1912) Ltd. is another important mining company which holds 20 leases to the north and east of the Golden Mile. An amalgamation in 1928 consolidated its holdings, which, although existing and producing since 1895, had been under different ownerships.

Since 1928 North Kalgurlie Ltd. produced 3,183,547 tons of ore which yielded 1,062,662 ozs of fine gold an average of 0.3335 oz per ton and is one of the most modernly equipped underground.



Dust from conveyor loading and discharge points is removed from air stream with modern equipment

Ore bodies exist in calc schist or fine grained older greenstones and quartz dolerite greenstones and in the southern sections ore bodies show wide variation in character and some consist of wide silicious lode material or of narrow telluride seams.

Payable ore reserves are estimated to total 2,234,000 long tons with an average of 0.33 oz and like Great Boulder and Lake View and Star, engineers predict that more than half century of economical gold production still exists in the Kalgoorlie field.

Rock temperature gradient on the Golden Mile is one degree Fahrenheit rise each 225 ft of depth and at 4000-ft levels rock temperatures average 90 degrees, but downcast and natural draft ventilation enables temperatures from 70 to 78 degrees in working places.

Kalgoorlie A Modern City

Kalgoorlie itself is a progressive city of 27,000 people, and unlike its early days when the municipality was proclaimed in 1895, over a conglomeration of canvas tents studded here and there with a more pretentious structure of hessian and galvanized iron, it is modern in outlook.

Civic amenities are good and far exceed those of other major mining centers of Australia. Streets are well laid out and a wise arboreal policy of the municipality has beautified 70 miles of footpaths by planting 3000 trees which include eucalyptus, peppers and jacarandas.

Kalgoorlie is the most important inland city of West Australia for not only does it bring unlimited wealth from overseas finance but it is the center of a vast primary producing area.

Fine and medium wools which have topped the West Australian market are grown on the excellent sheep country north of the city and excellent food production has been achieved by growing good cattle in other areas.

Recreational facilities include spacious and verdant parks with wide lawns, trees and shrubs and an excellent swimming pool to Olympic standards which is the only one of its kind in the State and a grassed oval provides ideal facilities for football and other field games.

The Kalgoorlie School of Mines is now a university for full time students in mining, metallurgy, surveying and engineering. Students have excelled under able and efficient teachers.

Pipeline Is Lifeline

But all this would not have been possible if it were not for the brilliance of the late C. Y. O'Connor, engineer-in-chief for the State who designed the famous Kalgoorlie Pipeline which piped water, 352 miles from Mundaring Weir Perth.

Granby type cars discharge ore onto grizzly on the No. 13 level of the Kalgoorlie Mine

O'Connor was an outstanding engineer whose work on Fremantle Harbour and the Kalgoorlie Pipeline reflected his farseeing estimates for in 1896 he estimated that Kalgoorlie would in the future require 5,000,000 gal of water each day and he designed his famous pipeline to carry such a quantity.

His vision and efficiency have been proven by the success of this long pipeline which snakes its way across the State of West Australia, for without it Kalgoorlie and its rich gold production would have perished for rainfall is light and artesian water is non-existant.

The pipeline now not only services the rich gold field of Kalgoorlie but branch lines have enabled the rich mining town of Norseman and the pastorial districts to survive.

Good Labor Relations

Industrial relations on the Kalgoorlie field are the best in the Commonwealth of Australia. The industry has an enviable record of industrial peace and amity exists between the Miners' Union and the Chamber of Mines of Western Australia.

The Chamber of Mines has provided an ambulance and hospital welfare scheme for mine employes and their dependents for many years and notwithstanding free hospitalization schemes now provided by the Federal Government, it still operates in a modified form to maintain free ambulance service and other welfare work the mines may wish to undertake.

Kalgoorlie produces 50 percent of Australia's gold from the Golden Mile and with at least half century of development and progress ahead it reveals the importance of this great mining center to the British Commonwealth of Nations.

It also reveals the proof of perseverance of Pearce and Brookman who undeterred by the mad scramble for alluvial gold set out systematically to prove their idea that a rich lode existed deep beneath the surface.

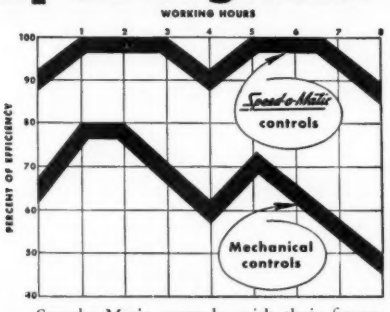
Pearce and Brookman became wealthy men but Hannan and his two Irish mates did not do so well, and Hannan, despite the fact that he was the discoverer of a field which has produced gold to the value of £A150 million ($336,000,000) it was necessary for the State to grant him a pension of £150 ($336) annually in his declining years.

Before you buy:

COMPARE ALL MAKES!

Up on the Range, Speed-o-Matic control is proving another outstanding feature of this rugged Link-Belt Speeder.

Speed-o-Matic power-driven hydraulic controls pay off in greater output and lower maintenance



Speed-o-Matic controls, with their finger-tip operated levers, are responsible for the above startling evidence of how operator fatigue can be reduced.

LINK-BELT Speeder's power-driven hydraulic controls reduce operator fatigue, minimize wear and tear on the machine and require far less maintenance than rigs with manual, air, vacuum or other control systems.

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The Wise Coal and Coke Company turned adversity into opportunity . . . decided to concentrate on coal's most profitable markets...to produce furnace, foundry and chemical coke and to ship only very low-ash coal for steam-coal use. To keep costs down, the mine went to full-seam mechanical mining. To keep quality and recovery up, a unique Heavy-Media Separation plant went in alongside the existing tipple.

The Problem and Its Solution

Heavy-liquid tests showed that a straight-line 1.40 separation of all $+\frac{1}{4}$" would produce desired 14,400 Btu coal with a 5% maximum ash, regardless of variations in r.o.m. But, due to variable partings in the seam, a 1.40 separation would reject appreciable coal adhered to bone and rock. Efficient middling

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MINERAL DRESSING DIVISION

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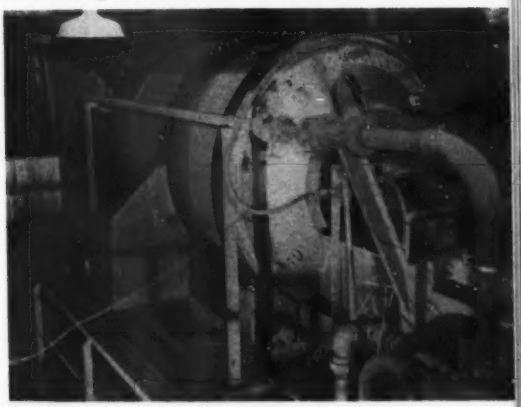
recovery and re-treatment were the key to profitable operation. Carload tests at a nearby Heavy-Media Separation plant confirmed these conclusions . . . and the practicality of a proposed flow scheme.

Accordingly, the Wise Coal & Coke Company contracted for a Heavy-Media Separation plant using a two-compartment drum to produce three-products from 3x¼" r.o.m. in one pass thru the separator. Raw feed is cleaned at 1.40 in the first compartment. Float coal overflowing a circular weir contains less than 5% ash . . . can be carbonized or shipped to premium markets. Sink (comprising middlings and true refuse) passes automatically to the second compartment where a 1.60 separation drops the refuse. Middlings are crushed to ¼" and re-treated on tables along with ¼"x0 material screened out at the tipple. Working two shifts, this plant has a capacity of over 1800 tons daily with a high over-all efficiency. Details of the flow scheme, equipment and operating results on this difficult separation are given in the reprint offered below.

What They Did . . . You Can Do

Why settle for less than maximum recovery of shipping coal when you build or re-build a cleaning plant? No matter how difficult the separation, no matter how the raw-feed fluctuates in tonnage, size-consist or percentage of near-gravity material, Heavy-Media Separation can closely duplicate heavy-liquid washability tests on your coal. No other process approximates the separating efficiency of true Heavy-Media Separation . . . no other process provides constant control, conditioning and recovery of the separating medium for maximum recovery of specification coal . . . no other process or equipment keeps your refuse so free from saleable coal!

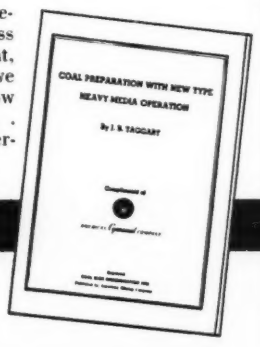
Feed end of Heavy-Media Separation drum. R.O.M. feed at center, 1.40 cleaned coal overflowing into chute at lower left.



Discharge end of dual-compartment Heavy-Media Separation drum

Discharge end of drain screen — Middlings on left — Refuse in center — Cleaned coal on right

If you have not read the fact-filled paper presented at the 1953 American Mining Congress Coal Meeting by J. B. Taggart, Vice-President, Wise Coal & Coke Company, Dorchester, Va., we invite you to send for a reprint. It shows how one company is solving its profit-problem . . . how Heavy-Media Separation can help you operate more profitably, too.



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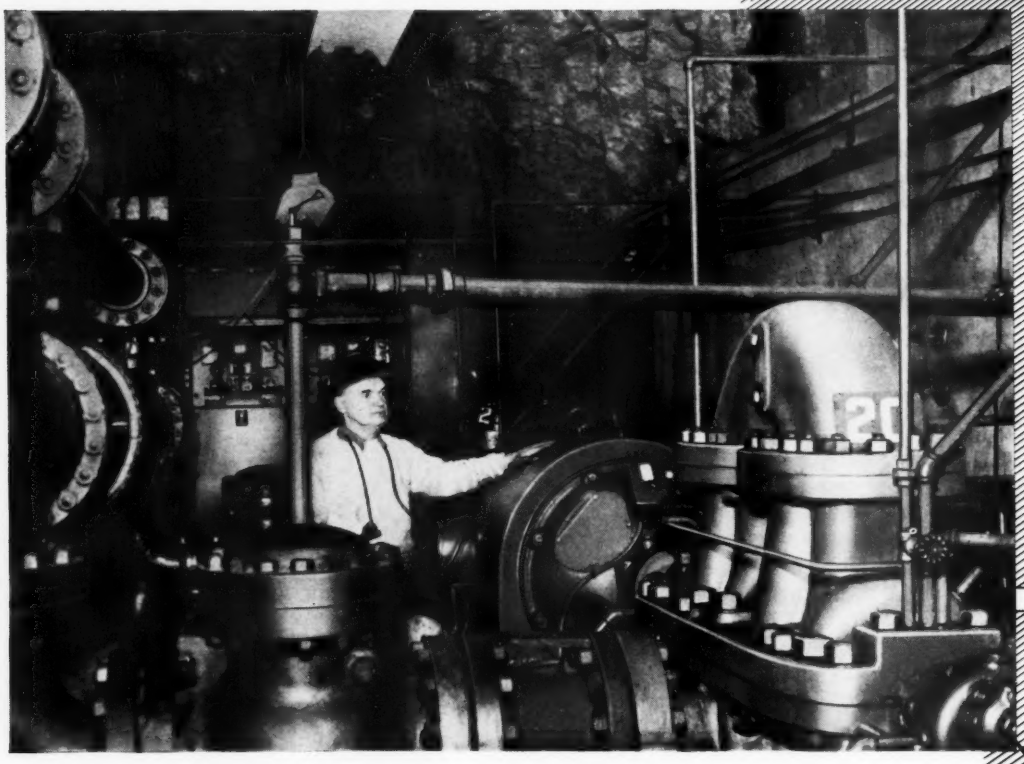

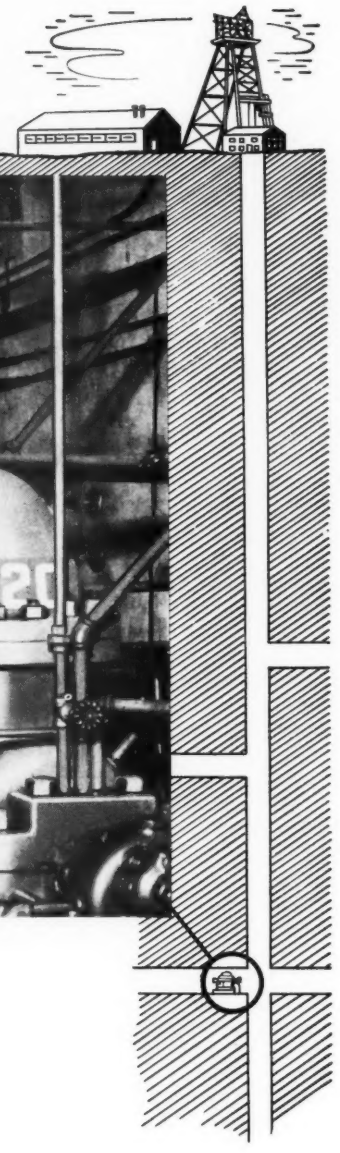

Ingersoll-Rand Drainage Pump
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has operated the equivalent of

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... without opening the casing!

The Ingersoll-Rand pump shown above was installed in 1943, on No. 17 level of the Bunker Hill and Sullivan Mining Company, Kellogg, Idaho. Since then, this six-stage, Class RTS unit has been pumping 820 gpm of drainage water at 1750 ft. head for a total of 67,420 hours — and some 3 billion gallons. The only maintenance so far has been periodic repacking. And the casing has never been opened.

Successful performance like this stems from Ingersoll-Rand's years of experience in the design, construction and application of mine pumps for both centralized and de-centralized drainage systems. Through this experience, I-R engineers can select the materials that will give long pump service, whatever your water conditions.

If you have a pumping problem, why not talk it over with your I-R representative. He's had lots of specialized experience and will be glad to help you.

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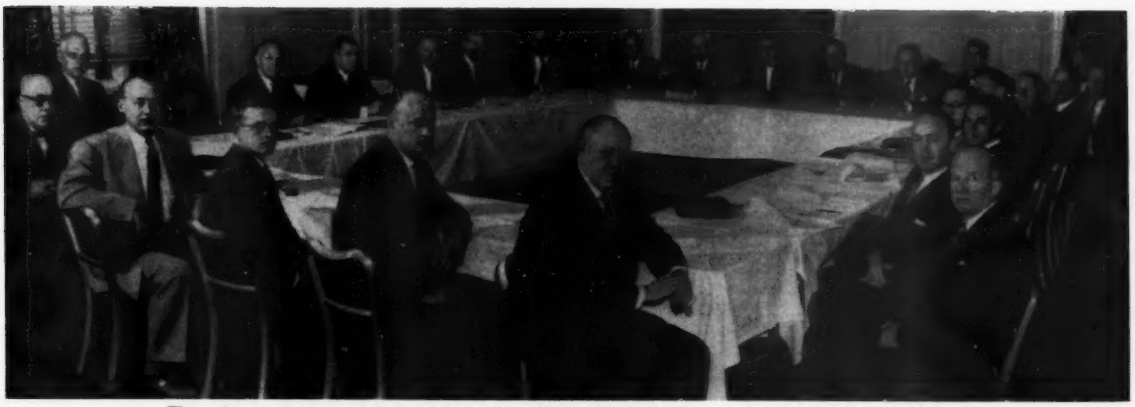

The primary concern at the meeting was to help the coal miner with his immediate problems

National Program Committee Meets to Choose Topics and Speakers for American Mining Congress 1954 Coal Convention

ON Wednesday, November 12, the Program Committee for the American Mining Congress 1954 Coal Convention met in Pittsburgh to lay plans for the meeting to be held at the Netherland Plaza Hotel in Cincinnati next May 3 to 5. National Chairman Edward G. Fox, President, Philadelphia and Reading Coal and Iron Co., presided at the morning and afternoon sessions where plans for the three-day meeting were discussed. Among the committee members present were representatives from all major coal producing areas of the country and the manufacturers who supply them with the tools and equipment needed to mine and prepare coal. Every phase of coal mining, preparation and safety was carefully reviewed by the committee in a determined effort to organize a program that would have broad appeal to all branches and segments of the industry.

The feeling of the group, and in a large respect the entire industry, is best summed up by the thought that the long range future for coal is bright indeed; that it is the immediate future, the next five or ten years, that give concern. This feeling was reflected in many ways as the Program Committee selected the topics that would help the coal miner with his immediate problems. On the other hand, the long range outlook for coal was not overlooked and subjects of paramount interest to coal men who are looking ahead were included.

Although one big job has been finished, there still remains the work of rounding out and polishing up the initial program as outlined by the Committee. Between now and Convention week there will be much "behind the scenes" activity to put into shape a program fully up to the high standards of American Mining Congress Coal Conventions.

Let's all meet in Cincinnati on May 3-5. Make your hotel reservations now!

Program Committee

EDWARD G. FOX, National Chairman

R. LAIRD AUCHMUTY, Cons. Engr., Pittsburgh
HENRY BARNHART, Baldwin-Lima-Hamilton Corp.
J. W. BROADWAY, Bell & Zoller Coal Co.
BIRCH BROOKS, Viking Coal Corp.
E. G. BROWN, U. S. Rubber Co.
R. J. CRAIG, Rochester & Pittsburgh Coal Co.
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A. F. DOBBRODT, Carboloy Division, General Electric Co.
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H. JOHN HARPER, Eastern Gas & Fuel Associates
GEORGE R. HIGINBOTHAM, Consolidation Coal Co. (W. Va.)
JAMES D. IRELAND, Peters Creek Coal Co.
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HARRY LaVIERS, South-East Coal Co.
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E. R. McMILLAN, Northwestern Improvement Co.
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KENNETH SNARR, Miners Coal Co.
J. B. TAGGART, Wise Coal & Coke Co.
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Even the coal enjoys the trips

Here are two more examples of Bethlehem prefabricated trackwork, both installed by companies that mine a lot of coal. The systems use heavy-duty rail; have long, high-speed straightaways, fine turnouts, and curves that were properly calculated before a rail was cut or laid. On track like this, the loads move smoothly; even the coal enjoys the trips!

It's the kind of track that gives a lift to haulage systems. Trips are faster and safer; a greater volume of traffic can be handled without snarls or tie-ups.

You can't see all the details in the pictures, of course, but some are easy to spot. Note how snugly the switch points fit against the stock rails. And how neatly the rails butt against the frog arms. And note, too, that there are no wide gaps between rail ends. Small details like these take careful planning, careful building—the sort you get in every Bethlehem track job.

Bethlehem prefabricated mine track is furnished with rails cut and curved. Holes are drilled for joint bars. Turnouts are complete and ready for quick assembly. Nothing is left to buy; the layout includes all switch stands, rail braces, guard rails, and other accessories.

Why not talk with our engineers? They're mining men, like you, and they specialize in track and haulage problems. When it is time to expand or revise your present layout, they can be helpful to you. Call or write us for more details.

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BETHLEHEM PREFABRICATED TRACK

Cooling Plants for Underground Workings—Part I

Climatic Conditions at the Face Can Be Controlled by Changes in Ventilation Practices. It All Adds Up to More Efficient Ventilation

By ANDRE HOUBERECHTS
University of Louvain
Louvain, Belgium

AS the working levels in coal and metal mines descend to greater and greater depths and the extent of the underground workings grows and the actual working faces move further away from the shafts, the climatic difficulties and working conditions become worse and worse.

In point of fact, human life is impossible except between very narrow limits of internal temperature; a man has a feeling of comfort only when his temperature is between 36.5 and 37.5° C (97.7 and 99.5° F), the temperature of his skin being between 33 and 34° C (91.4 and 93.2° F). The continual output of calories, which is due to the process of metabolism and is particularly intense during heavy work, opposes the maintenance of such a temperature in the organism. In fairly cold surroundings, the heat produced by the body is compensated by losses due to convection and radiation, but when the atmosphere or the surrounding walls reach a temperature higher than 33° C (91.4° F), the flow of calories due to these last two phenomena is reversed and the only remaining way for the body to dispose of calories is by perspiration. This is encouraged by a dry atmosphere and a rapid air current; it ceases in surroundings saturated with water vapor.

Consequently, the dry-bulb temperature t_d, which is shown by an ordinary thermometer, is not sufficient to indicate the degree of comfort provided by a given set of climatic conditions; the wet-bulb temperature t_w (the limiting temperature reached by a moistened surface in a rapid air current), must also be taken into account, as well as the speed of the air in the given conditions, the barometric pressure and the degree of radiation of the surrounding walls.

In the case of mine workings, the effect of radiation appears to be of little importance so long as the workings are properly ventilated; this is also true of the barometric pressure, which is taken into account by the variable t_w, and of the speed of the air, provided this does not exceed approximately 90 fpm.

In other words, the possibility of working in a given set of conditions depends only on the dry and wet-bulb temperatures t_d and t_w; certain experiments carried out during the last war showed that lightly-dressed men accustomed to working in these conditions can carry out heavy work continuously as long as the effective temperature t_e, defined by the formula

$$t_e = 0.9\ t_w + 0.1\ t_d$$

was lower than 93.2°F. On the basis of these experiments, it has been agreed in Belgium that the period of work can be maintained at its normal length as long as the effective temperature in the working remains below 87.8°F.

When it leaves the surface on its journey underground, the ventilating air satisfies this condition to a large extent, at least in Belgium. But as soon as it reaches the downcast shaft and quite independently of the heating action of the walls of the shaft, the temperature of the air increases, by reason of the fact that it undergoes compression due to the rise in barometric pressure with increasing depth. This compression causes the temperature to rise, very approximately by one deg C per 100 m (2° F per 300 ft).

During the whole of its journey along the roadways which are in rock with a relatively higher temperature and very often with a high moisture content the ventilating air becomes more heated and charged with water vapor. In addition to this, the coal which has been mined is transported in the intake airways, either by conveyor belts or in cars hauled by locomotives. The heating action in these regions is considerably aggravated in the working area itself, where new surfaces of coal and rock are continually being exposed, the temperature of these may reach 40 to 50°C (104 to 112°F) according to the depth of the working. Finally, the oxidation of the coal constitutes a very important source of heat in the ventilation air current.

Enumeration of these various factors is enough to show that the climatic problem becomes more and more difficult to solve as the depth of the

Air shafts should be built to offer the least possible resistance to air passage

workings increases and as their distance from the shaft grows.

In the majority of cases, a well-organized ventilation system will suffice to maintain an effective temperature of less than 31°C (87.8°F) at the faces. However, when the depth of the underground workings exceeds 3000 ft and the atmosphere is moist, the ventilation system may well prove incapable of doing this and a cooling installation may become necessary.

Climate at the Face

Factors governing the climate at the face can be determined by examining a thermal balance-sheet. Although it is a complex matter to set up a balance-sheet of this kind, it is nevertheless possible to do so by means of a few simple considerations which closely approximate the results reached by tests.

Supposing that the air enters the face saturated with water vapor and at a temperature $t = t_w = t_d$ and that it leaves the face, still in a saturated state, at a temperaure of 30°C (86°F) this gives better climatic conditions than the limit prescribed by regulations. If we now plot in a graph (Fig. 1) the heat removed by the air (in kcal/hour) as a function of the air flow (kg/sec), we obtain a straight line, the angular coefficient of which is proportional to the number of kcal carried away by each kg of air. Since the temperature of the air on leaving the face remains at 30°C (86°F), the angular coefficient will increase as the temperature (t) diminishes. For different values of (t), different straight lines are thus obtained, radiating from the origin. In addition, let us suppose that the output of coal (P) on this face is 200 tons per shift. For a production of this order, the surface of new rock and coal exposed to the air per hour has the temperature (T) which is above that of the air (t), and has on the average a fixed value (S). The heat transmitted by this surface to the air current is, moreover, proportional to (S) and to the difference in temperature between (T) and the average 0.5 (t+30). For a given output (P) and for every value of (t), it is then possible to calculate the number of kcal/hr released by coal mining. If, on each of these straight lines (t) on the graph, we mark the point which corresponds to this heating action, we obtain a hyperbolic curve showing that a reduction in the temperature (t) actually increases the emission of heat at the face. Different values for (S) correspond to different values for (P) and, consequently, different curves are obtained. A certain number of these are also represented diagrammatically in Fig. 1.

It is very easy to solve, by means of this diagram, the problems which bring into play the simultaneous effects of the three factors, output (P), temperature of air on entering the face (t) and flow of air. For example, supposing that a given face yields 200 tps and that the ventilation air enters the face in a saturated state and at a temperature (t) of 20°C (68°F). In order that the temperature of the air, which is assumed to be saturated, should not exceed 30°C (86°F) on leaving the face, the flow of air must be 8.6 kg/sec (15,000 cfm), as shown by the abscissa of point A. If it is desired to increase the output of the same face to 300 tps, without modifying the state of the air, either on entering or on leaving the face, i.e. while maintaining the same climatic conditions, the flow of air must be increased to 13 kg/sec (23,000 cfm), as shown by the abscissa of point B. It would be possible to retain the initial air flow, however, if the saturated air is not to exceed 30°C (86°F) on leaving the face, it will be necessary to cool the air as it enters the face, to a temperature of 3°C (37°F), this being the value (t) corresponding to the straight line passing through the point C. Finally, it would have been possible to maintain the air at 30°C (86°F), in a saturated condition on leaving the face, by modifying simultaneously the temperature of the air on entering the face (e.g. by reducing it to 15°C (59°F)) and the air flow (reducing this to 10.4 kg/sec (18,356 cfm)); these values would have been given by point D on the diagram. From reasonings of this kind, it can be concluded that for a given output, the climatic problem can be resolved either by increasing the ventilation or by reducing the temperature of the air as it enters the face, or by a combination of the two.

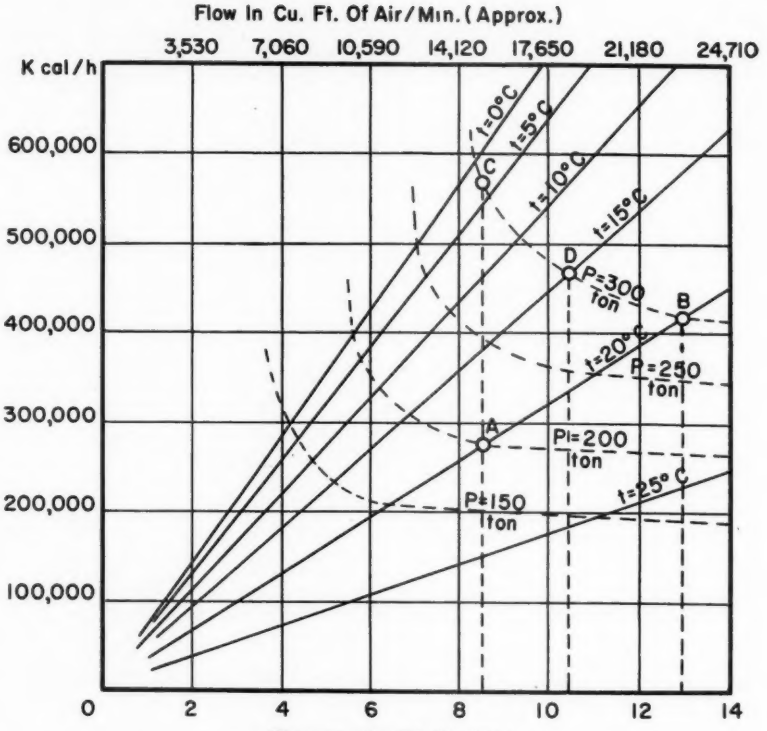
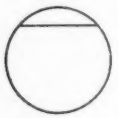


Fig. 1. Heat removed by air as a function of the airflow at different temperatures

We shall examine these various solutions successively. First of all, however, it is necessary to draw attention to the effect of the mechanical equipment used on the climate of the workings; this effect has no connection with the preceding considerations, since it was supposed, for the sake of simplication, that all the heat produced at the face was emitted by the coal extracted.

Equipment Effects on Climate

Compressed air equipment is used extensively in some anthracite and metal mines for mining and transportation. Experience proves that compressed air reaches the workings at a temperature which is, for all practical purposes, the same as that of the ventilating air. When the compressed air expands to produce driving energy, the air is discharged from the machines which it has set in operation at a lower temperature than that of the surrounding atmosphere and it can thus produce a certain local cooling effect. However, the work done by machines operated by compressed air consists as a rule either of percussive or frictional movements, whose heating effect is exactly equivalent to the cooling effect produced

Cross-section of lay-out		Resistance in mm of water	HP
	(1) Bare concrete-lined shaft	13 (0.51 in.)	9
	(2) Concrete-lined shaft with ladderway 0.80 m (31.5 in.) in depth divided off by a smooth partition	22 (0.865 in.)	15
	(3) Concrete-lined shaft with guide rails, the latterway and the small passageway opposite each being divided off by a smooth partition	43 (1.69 in.)	28
	(4) Shaft 3.50 m (10.5 ft) in effective diameter lined with Toussaint-Heintzmann metal frames 1 m (39.37 in.) apart.	39 (1.53 in.)	26
	(5) Smooth shaft with ladderway landings 0.80 m (31.5 in.) in depth and 6.08 m (19.6 ft) apart	60 (2.36 in.)	40
	(6) Smooth shaft with ladderway landings 0.80 m (31.5 in.) in depth, 6.08 m (19.6 ft) apart and intermediate cross beams halfway between the landings	56 (2.20 in.)	37
	(7) Smooth shaft with ladderway landings and partitions 6.08 m (19.6 ft) apart, the latter perpendicular to the landings	95 (3.74 in.)	63

Cross-section of lay-out		Resistance in mm of water	HP
	(8) Smooth shaft with ladderway landings 6.08 m (19.6 ft) apart and partitions 3.04 m (9.8 ft) apart, perpendicular to the landings	111 (4.36 in.)	74
	(9) Smooth shaft with central partitions 3.04 m (9.8 ft) apart	65 (2.56 in.)	43
	(10) Smooth shaft with ladderway landings 6.08 m (19.6 ft) apart and cross beams 6.08 m (19.6 ft) apart, perpendicular to the landings	119 (4.68 in.)	79
	(11) Smooth shaft with ladder landings 6.08 m (19.6 ft) apart and cross beams 3.04 m (9.8 ft.) apart, perpendicular to the landings	170 (6.69 in.)	113
	(12) Smooth shaft with guiding cross beams 3.04 m (9.8 ft) apart	67 (2.63 in.)	45
	(13) Smooth shaft with ladderway landings 6.08 m (19.6 ft) apart, cross beams halfway between and partitions 3.04 m (9.8 ft) apart parallel to the landings	150 (5.90 in.)	100
	(14) Smooth shaft with landings 6.08 m (19.6 ft) apart, cross beams halfway between and guiding cross beams placed at the side opposite the ladder landings and 3.04 m (9.8 ft) apart	116 (4.56 in.)	77

Fig. 2. Pressure losses in shafts

by the heating of the expanded air from its exhaust temperature to the temperature of the surrounding atmosphere.

Taking all these factors into account, it is therefore impossible to attribute any cooling effect at the face to the expansion of the compressed air. The only exception to this rule would be where compressed air is used as the motive power in an appliance intended to overcome the effect of gravity.

Nevertheless, if all compressed-air equipment were replaced by electrically-driven apparatus, the percussive and frictional work remaining the same would no longer be compensated by the cooling effect of the expanding compressed air and it would be necessary to enter in the thermal balance-sheet of the face the calorific equivalent of the total amount of electric current used, which may constitute a significant item.

Keep Compressed Air Dry

An additional cooling effect is also produced at the face by the compressed air, not as a result of its expansion, but by reason of its low water-vapor content. If we study the variations in the moisture content of the air during compression, it will be observed that the air leaves a considerable quantity of water in the condensers, which are intended not only to reduce its temperature but also to reduce the power required of the compressor. If the traps function efficiently and the compressed air is suitably cooled, although it is saturated with water vapor it does not contain more than 3 to 4 g/kg of dry air, whereas the ventilation air reaches the workings with an absolute humidity of the order of 10 to 20 g/kg of dry air, according to the season and according to the greater or lower humidity of the shafts and roadways.

By mixing with the ventilation air, the expanded compressed air reverts to the same level of moisture content; this means that in the wettest mines it is capable of taking up by evaporation some 16 g of water per kg of dry air. The corresponding cooling action is 9.3 frigories* per kg of compressed air used.

As an example, let us consider the thermal balance-sheets of a face equipped with electric or with compressed air machines, of a total power rating of 100 hp.

Comparison shows a balance in favor of compressed air of some 130,000 kcal/h. This figure is made up as follows:

(1) The calorific value of the energy consumed, that is 63,000 kcal/h, which has to be entered on the balance-sheet of the face using electricity, but not on that of the face using compressed air;

(2) The heat necessary for evaporating the water in order to bring the moisture content of the compressed air to the same level as that of the ventilation air; for a consumption of 7200 kg/h corresponding to the power nature under consideration, this amounts to (9.3 x 7200) kcal/h.

These considerations show the importance of a sufficient degree of cooling and drying of the air compressed at the surface and the necessity of fitting an efficient device for separating the water before the compressed air is fed underground.

Having dealt with the effect on the climate of the face of the type of power used to drive the winning and transport equipment, it is proper to mention at this point the effect of wet methods of dust suppression. Experience has proved that they bring about an increase in the moisture content of the air, which varies according to the method used. In theory, if the heat drawn from the coal and the rock by the air stream remained constant, the evaporation of water at 30°C (86°F) should considerably reduce the dry-bulb temperature and raise, to an imperceptible degree, the wet-bulb temperature. In fact, the increased exchange of heat with the walls of the workings reduces any variation in the dry-bulb temperature. In addition to an increase in the humidity of the air, wet methods of dust suppression also cause a slight increase in the heating action of the walls of the mine, and a general rise in the effective temperature by from 0.5° to 1°C (1° to 2°F).

Cooling With Ventilation

When efforts are made to insure satisfactory climatic conditions in a working place, the first method which is generally tried is that of increasing the ventilation airflow. However, there is a limit to the extent to which ventilation can be increased at the face; if the speed of the air current exceeds 8 to 10 ft per sec, there is a risk of stirring up excessively large quantities of dust. For a face of from 1 m to 1.10 m (3.25 to 3.60 ft) total thickness the airflow can be as much as 12 or 13 cu m/sec (25,000 or 27,500 cu ft per min).

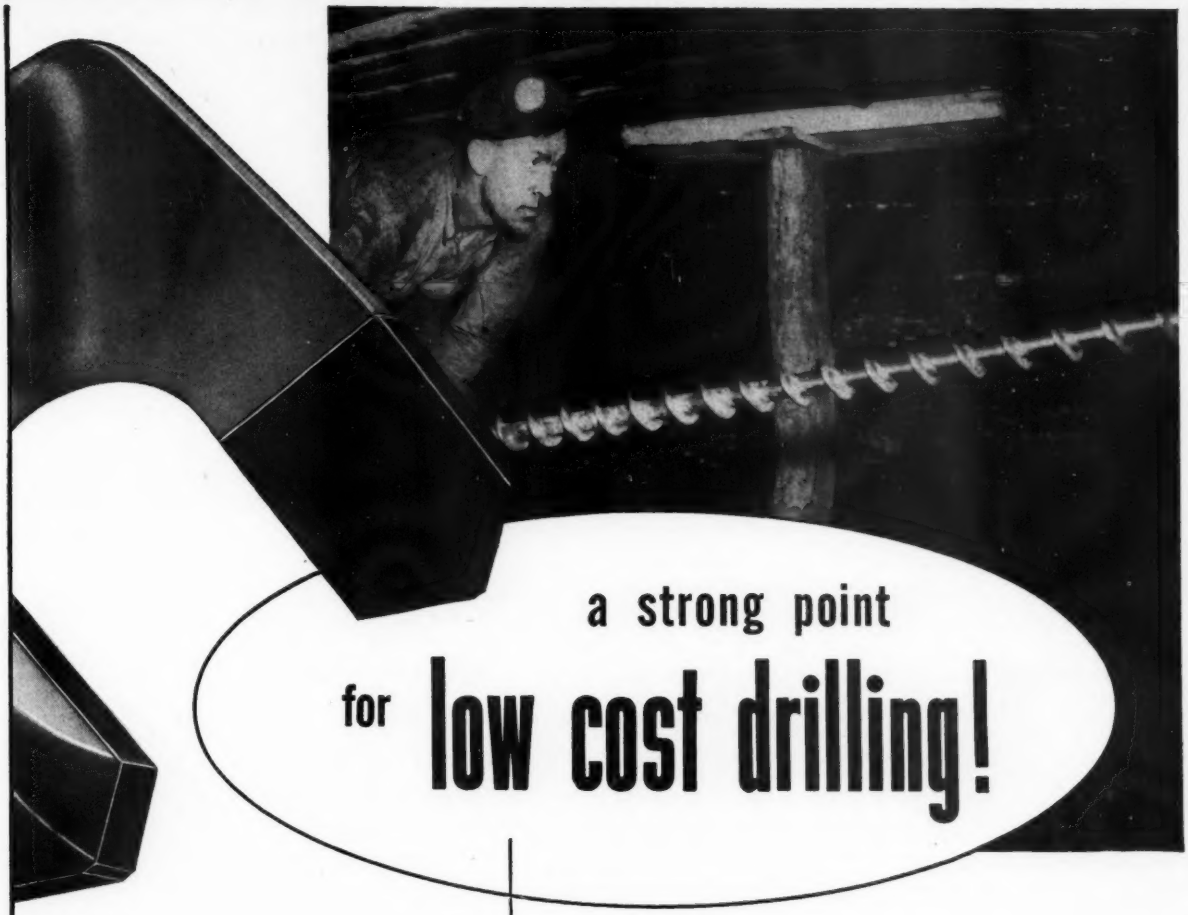
In addition to this, it is difficult to increase the ventilation of a mine as a whole, because shafts of relatively small diameter frequently tend to act as a bottleneck, thus reducing the total flow of air on the one hand, and on the other wasting a considerable proportion of the power of the ventilating fans.

It would thus seem advisable to fit out the shafts in such a way as to reduce their resistance to the passage of air, with a view to improving the ventilation of the workings. Very interesting data on the possibility of

(Continued on page 68)

* Frigorie is a French unit of measuring heat exchange in terms of kcal.

Heat can be removed from the face by cooling the ventilating air, providing more air, or a combination of the two



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Mine mechanization's future was discussed at the Annual Luncheon

Coal Division Committees Report

Annual Conference in Pittsburgh Outlines Latest Developments in Equipment and Operating Practice

THE Coal Division of the American Mining Congress met in Fittsburgh, Pa., for its 19th Annual Conference on November 13. At the conference, held in the William Penn Hotel, the various Coal Division technical committees reported on studies that have been completed since the last conference and those that are now in progress. Over 200 representatives of mining and manufacturing companies were present to hear and discuss current mining problems.

These Annual Conferences not only report on work being done by the several committees but also allow an exchange of views on each study. Those who attend derive great benefit from the experiences of recognized mining authorities who make up the committee membership. All reports are prepared with the original Coal Division objective in mind—to present to the industry the facts concerning modern mining methods and equipment without recommendation for or against.

Luncheon Meeting

At the well attended luncheon, coal mine mechanization, past, present and future, was discussed. Glenn Southward, mechanization engineer for the American Mining Congress, reviewed activities of the Coal Division since its organization 27 years ago. After describing some early problems of mechanizing coal mines, he introduced Dr. L. E. Young, the luncheon speaker, as the *Father* of the Coal Division. Dr. Young was the chairman of the National Committee on Mechanized Mining organized in 1926. This group was later called the Coal Operators Committee and subsequently evolved into the present Coal Division of the American Mining Congress.

"The Coal Industry's Objective in Complete Mechanization" was the title of the talk given by Dr. Young. He mentioned some of the development projects now under way in the industry and went on to say that "when we try to state our present objectives and what our ultimate objectives should be in order to mechanize our bituminous coal mines, we think of

"(1) The job of making a success of the mines now in operation, literally keeping them from being abandoned.

"(2) The challenge of competitive fuels and the social problem of sustaining communities depending on mining.

"(3) The opening and development of new mines in strategic locations to furnish coal for metallurgical purposes and for electric power plants using the most up-to-date equipment with mining plans taking the fullest advantage of the new types of equipment and mining practice."

Will Have to Mine Thin Seams

"With the depletion of the thicker coal seams at shallow depths located where good roof conditions prevail," Dr. Young went on, "we must mine thinner seams at greater depths with less favorable roof. The future demands the ability to cope with these more difficult conditions.

"We have developed better bits for cutting machines and drills, better gears, better motors, better alloys, better conveyors, better lubrication, and better methods for using and maintaining equipment. All these have contributed greatly to mechanization in recent years.

"Today some of the best designers in the United States are working on the fundamental problems of combined cutting-and-loading coal, transportation away from these machines, roof bolting equipment that will meet present and future requirements, and low height loading machines, both conventional and continuous types."

Dr. Young concluded, "It seems to me that when we have achieved these goals, we will have made good progress toward complete mechanization and can then undertake new problems incident to complete mining at depth."

With the conclusion of the luncheon meeting, the Coal Division reports were resumed in the Monongahela Room.

The abstracts which follow were condensed from the various committee reports as they were presented to the conference. They recount progress on each study and are subject to change resulting from the exchange of ideas and critical appraisal of men from all parts of the industry that is an integral part of Coal Division meetings. Future issues of MINING CONGRESS JOURNAL will carry the full reports after the studies are completed.

UNDERGROUND POWER

Committee Chairman
C. C. BALLARD

UNDERGROUND INSTALLATION OF HIGH VOLTAGE CABLES

C. R. HUFFMAN

THE objective of this study is to cover the major phases of high voltage cable installation in coal mines. Underground mechanization has reached the point where the use of high voltage is not only desirable to maintain proper power and stability at the machines, but, in some cases, is the only practical solution. These high voltage circuits must be correctly designed and installed with adequate protective devices. Through various subcommittees and task groups, recommended practices are in preparation and abstracts of the preliminary reports are presented in the following accounts.

HIGH VOLTAGE CIRCUITS

J. A. DUNN, M. R. MORTON AND E. L. PARKER

RULES and laws governing the use of high voltage cable in coal mines have been made to cover the worst conditions. In order to follow these rules, installation costs are often high and operating conditions difficult. Frequently there is a great difference in recommendations of various agencies and of State mining departments. There is a reason for this because under certain conditions the use of high voltage cables in coal mines can become a hazard that must be guarded against.

There is a high voltage system, however, that can be used, in which hazards are minimized. In this system, the high voltage mine circuit is served from a wye connected source with the neutral grounded so that the ground current is limited to a low value. The purpose of this system is to reduce voltage drop to a safe level in case of failures, between any equipment connected to the high voltage system and the ground. Also, to reduce cable faults and equipment damage. It is reasonable to believe that if the mining industry used only this type of high voltage system, experience would prove the safety value to such a degree that some of the economic objections to cable installations would be minimized.

To gain the advantages of the controlled ground current circuit, the high voltage circuit entering the mine should be served from a separate transformer bank. This is to obtain the neutral for the cable ground circuit into which can be inserted a current control device. The transformer may serve other outside 3-phase loads if proper switching devices are used and their control relays coordinated.

A high voltage circuit entering the mine should be protected on the outside by an oil circuit breaker of suitable size and voltage rating. The breaker should have adequate interrupting capacity and should be tripped on phase overcurrent and ground current. If the circuit enters the mine through a borehole, there should be a suitable manual switching device at the bottom of borehole such as a subway type oil cutout. If high voltage cable couplers are used, these should be locked and interlocked with a switching device in the circuit.

All switching devices, cable couplers and high voltage equipment should be grounded at the particular equipment but this ground should be separated from, and up to 15 ft away from, the mine track. Ground wires in the cable circuit should be continuous and should be connected to all couplers, switching devices and high voltage equipment. Where a piece of high voltage equipment is operated on the mine track, the track under the equipment should be separated from the regular mine track by 15 ft if possible.

If track bonding and return feeder cables are in proper order very little direct current should flow in the ground wires of the high voltage cable circuit. This should be checked from time to time at each piece of conversion equipment and should never be allowed to go above 40 amp. If the current reaches this level, it is a good indication that track bonding is out of order or the track is open electrically.

CABLE FAULT FINDERS

R. G. GEHLSEN

FOR locating various kinds of faults in the numerous designs of cable, there are several types of equipment available. This report is intended to be a general guide for using equipment, expressly designed for fault finding in portable neoprene jacketed cable. There are three basic types of this equipment.

TYPE (A) Condenser—discharge method
TYPE (B) Signal generator
TYPE (C) A-C Tracer method, thyratron tracer method, various bridge arrangements, loop type, etc.

Type A has the advantages of (1) giving an audible sound at point of cable failure; (2) being able to locate "dead shorts" with aid of "pick-up" search coil and earphones; (3) "Hi-Pot" repaired cables; (4) and is particularly adaptable to cables designed to carry 2000 or over. Its disadvantages are: (1) It requires an external power supply; (2) it employs high voltage; (3) there is difficulty in finding "opens" when more than one exists; (4) and the cable remains charged, should no discharge occur at fault—it needs manual discharge.

Type B has the advantages of (1) a self-contained power source; (2) excellent performance on "opens"; (3) excellent performance on "dead shorts"; (4) having no dangerous voltage impressed on cable; and (5) of having maximum suitability for multi-conductor cables in low-voltage class. Its disadvantages are: (1) It limited success on "high resistance" shorts; (2) there has been little or no success when used on lead-covered cable; (3) and little or no success can be expected in locating "opens" and only moderate success in locating shorts in wires housed by conduit.

Type C methods merit study in the over-all picture. Their application appears to be more for the type of fault that is found in high-voltage sub-stations where the length of cable together with its permanent characteristics are known.

MINE POWER FEEDERS

T. R. WEICHEL

THE type of cable generally used for high-voltage power circuits in mines may be classified as either metallic armored or shielded non-metallic armored. The former includes those in which steel wire, flat steel tapes or interlocking steel tapes are used to give protection against mechanical damage.

The latter has a fibrous armor, tough neoprene sheath, or composition sheath that provides protection against mechanical damage. Conductors are insulated with a high voltage insulation and shielded with a tinned copper shielding tape. Bare grounding conductors are placed in the interstices in contact with the shielding and the complete assembly is encased in neoprene. This cable is suitable for installation in boreholes, shafts or horizontal runs in underground entries. It may be carried in a trench, placed on the mine floor, or suspended on insulators. It is a semi-portable cable that can be moved easily from one place to another and is suited to modern high-speed mining applications requiring frequent movement of the conversion equipment.

Power cables leading underground through shaft open-

ings or boreholes are accepted as being metallic-armored and suspended by means of the individual armor wires. This type cable with steel-wire armor is undoubtedly the preferred cable for permanent installation. It can be supported by the armor wires without strain on the conductors and also affords protection against mechanical damage from falling material or moving equipment in the shaft. However, there are many cases where the protection of metal armor is not necessary or where the length of suspension does not require the support of armor wires. Installations of this type can be made with neoprene-armored cable and still satisfy safety requirements.

Whether the cable is supported by clamping over the cable sheath or by the individual conductors, the conductors are the supporting members. Grounding conductors should not be considered as aiding in support of the cable. Undue strain in the cable sheath, insulation and conductor should be avoided when planning the cable installation. A suitable safety factor is the ratio of breaking strength to stress and a factor of seven is recommended.

Potheads are generally used to seal the cable end against moisture and to provide proper spacing and insulation between terminals. This method of terminating is not used where it is necessary to support the cable in the shaft or borehole by the individual conductors but it is suitable for terminating the end of the cable on the surface or in the mine. Shields and ground wires are terminated within the pothead. A stress cone is applied at the termination of the shielding within the pothead and grounding conductors and shields securely bonded to one another and terminated to the grounding terminal of the pothead casting. When the cable is supported by the individual conductors in shaft or borehole, care must be exercised in terminating the conductors and shielding and protecting the installation against the weather.

Many factors must be considered in the underground installation of the high-voltage power cable, such as voltage and load requirements, length of circuit, permissible voltage drop, etc. These factors are generally the responsibility of the electrical engineer, but the safety of the installation is of prime importance to all concerned.

ASA Safety Rules that apply to cable installation are described and explained in detail in the report.

MINING MACHINE MOTOR IDENTIFICATION

F. R. HUGUS

DISCUSSIONS held during recent meetings of this committee indicate that the mining industry will benefit if a uniform and recognized system of presenting motor ratings is in common use. At this time not enough information is available concerning the users' requirements and any information presented now must be considered as a progress report subject to alteration as new data and requirements become available.

Many existing variables in the mining industry materially affect the study of mining machine motor identification. Perhaps the most important is variable voltage. Modern mining machines demand more power which, in turn, creates greater voltage drops so that now it is not uncommon to note machine voltages as low as 150 v at the motor terminals. This is far too low for a 250-v machine. A motor with 200 v at its terminals cannot have the same horsepower rating as a motor operating with 250 v at its terminals. This raises the question—Should motors be built and name-plated for normal voltage or low voltage?

The most desirable arrangement is to build motors for one specific voltage and state their characteristics on the name plate for this voltage. This will allow the industry to work on a common standard, permit maximum interchangeability of electrical equipment and, most important, encourage all users to strive to maintain proper voltage at the machine.

Another question is should the horsepower of the motor be based on continuous or intermittent duty? Continuous duty is preferred because the increased tempo of modern mining demands that motors operate closer to continuous duty than intermittent duty. Even motors on a pulsating load must have equivalent continuous horsepower rating which could be arrived at by calculating the root mean square horsepower required of the motor. On the other hand, a very good argument can be presented in favor of an intermittent rating. The erratic loads imposed upon many mining machine motors demand greater than the one-hour rating.

PROPOSED SPECIFICATIONS FOR HIGH VOLTAGE CABLES

By E. C. Sturdevant

Three Conductors, Shielded, with Grounding Conductors
Non-Metallic Sheathed

Size Awg	Number of Strands Class B	Number of Strands Class C	Current Capacity, Amp 75 C Inc.	Grounding Conductor Size in Each Interstice, Awg	Insulation Thickness, 64th Inch Grounded	Insulation Thickness, 64th Inch Ungrounded	Over-all Diameters, Inches Grounded	Over-all Diameters, Inches Ungrounded
				5000 Volts				
6	7	19	72	10	10	10	1.49	1.49
4	7	19	93	9	10	10	1.60	1.60
2	7	19	124	7	10	10	1.74	1.74
1	19	37	142	6	10	10	1.85	1.85
1/0	19	37	163	5	10	10	1.94	1.94
2/0	19	37	191	4	10	10	2.05	2.05
3/0	19	37	214	3	10	10	2.16	2.16
4/0	19	37	245	2	10	10	2.29	2.29
				10,000 Volts				
6	7	19	75	10	14	18	1.81	2.10
4	7	19	99	9	14	18	1.92	2.20
2	7	19	127	7	14	18	2.06	2.36
1	19	37	144	6	14	18	2.14	2.45
1/0	19	37	168	5	14	18	2.20	2.55
2/0	19	37	195	4	14	18	2.36	2.65
3/0	19	37	220	3	14	18	2.48	2.76
4/0	19	37	250	2	14	18	2.60	2.89

Note: A grounded system is a system of conductors in which at least one conductor or point (usually the middle wire or neutral point of transformer or generator windings) is intentionally grounded either solidly or through a current limiting device. An ungrounded system is one in which no point is deliberately connected to earth except through potential or ground detecting transformers or other very high impedance devices.

AN UNDERGROUND POWER DISTRIBUTION SYSTEM

C. C. CONWAY

POWER is delivered to this mine at 34.5 KV. Power for outlying drill holes is transformed to 12,470 v wye. The neutral is solidly grounded on the overhead transmission line. The underground load is all at one location and it was decided, for purpose of control of interrupting capacity, to make two complete systems, transforming by two banks and enter the mine through separate cables. Each system consists of three 500 KVA transformers delta connected on the primary, and wye connected on the secondary. The secondary is 4160Y and the neutral point is grounded through a current limiting resistor placed immediately at the transformer. The bore hole cable and all other underground cables are insulated for 5000 v; ground wires and shields are solidly grounded at the transformer banks, and the transformer neutrals are grounded only through the grounding resistor.

On the surface, power from the transformers is through a circuit breaker before going underground. At the termination of the bore hole cable underground, additional disconnecting and circuit breaker protection is provided on the main circuit. In addition, the underground load is divided by means of circuit breakers and feeder panels into several circuits. Main panels on both surface and underground are equipped with two overcurrent relays, plus one ground trip relay and a current balance relay. It is thought that any phase to phase fault will be caught by one of the overcurrents and that a failure to ground on any phase will be caught by the ground trip relay.

The cable is of non-metallic type and Neoprene jacketed. It is installed by hanging from the roof on insulated supports, placed at approximately 15-ft intervals. In most cases, two cables are used in a double hangar. A high voltage sign is placed on the cables approximately every 200 ft, and the method of hanging is so arranged that ordinarily there is no question regarding which cables are high voltage. All cables are installed in 1000-ft lengths, and every termination is in a specially constructed, airtight and water-tight junction box. Terminations on the cable are permanently stress-coned and otherwise made up with an entrance fitting so that they may be removed and replaced in junction boxes at will. Load break switches are placed at intervals and are so arranged to take cables without alteration of termination.

Grounding of the transformers through a resistor has been mentioned. At the receiving ends of the cables the ground wires of the cable are, in every case, connected to the machines they are serving, i.e., in service to a motor generator set, the ground wires of the cable are connected to the M-G set frame as well as the switching equipment serving the M-G set. In addition, the M-G set is grounded to the rails.

STANDARDIZATION OF MOTOR LEAD CABLES AND HOSE CONDUITS

J. A. BUSS

IT has been recognized for some time that the wide range of cable types and sizes used in the industry for any given horsepower rating of motors and controllers has imposed a serious burden on both manufacturers and users, and has caused much delay and unnecessary cost in manufacture and use. To alleviate this condition, the Committee on Underground Power of the American Mining Congress has made a study of the problem and has developed recommendations for cable and hose conduit sizes for general purpose U.S.B.M. Explosion Proof Motors. Their recommendations are for consideration by NEMA Joint Sections Committee on Motor Lead Cables and Hose Conduits for Explosion-Proof Motors for Mining Belt Conveyors. Attention is directed to the following:

Only general purpose continuous duty motors are included. No attempt has been made to cover special motors specifically designed for "built-in" applications on mining machines, as these generally have special cable requirements dictated by factors, other than horsepower rating. Typical applications are pumps, conveyors, fans, compressors, etc.

The recommendations definitely do not apply if the motor cable is on a reel or is a trailing cable.

The assumption is made that the probability of general purpose motors being used in locations necessitating grounding via the motor cable justifies the use of cable with grounding conductors connected to the motor frame as standard practice.

The report included definite recommendations as to size of conductor and cable construction and included three tables covering outside cable diameters and inside hose diameters for various sizes of conductors for three-phase ac motors, non-reversing and reversing dc motors.

VENTILATION

Committee Chairman

A. J. OPPERMANN

SOURCES AND PREVENTION OF AIRBORNE DUST

W. D. NORTHOVER

SEVERAL case histories on sources and prevention of airborne dust were presented in the 1952 preliminary report and from these accounts the following procedure for dust control is recommended where the application is practical.

Water should be applied to the cutter bar; drill cuttings should be wetted while drilling; sprinkle the face before shooting; sprinkle the shot coal before loading; use spray on machine while loading; clean up and load out accumulations of dust before the face is prepared for the next move; and use dust collectors, or water, in roof drilling. Loading points for conveyors and mine cars should have water sprays; spillage along transportation lanes should be removed promptly; stations to sprinkle cars or loaded trips should be conveniently located; high velocity air should be avoided on haulageways; sprays can be provided behind line brattices to trap dust escaping from the face region; rock dust all mine workings; and finally, "keep your house clean."

In addition to water spraying, the Committee calls attention to another method employed, or proposed, for the

Watering coal in mine cars helps keep coal dust under control while in transit to the tipple

removal of airborne dust. This plan uses a permissible auxiliary suction fan and reinformed flexible tubing to supplement standard face ventilation. The purpose is to exhaust airborne dust from its point of origin. An experimental unit is being used by special permission and if approved as successful, its description will be given in a subsequent report.

SEALING AND VENTILATING MINED AREAS

W. D. MEAKIN

IN many States the mining laws specify whether sealing or ventilating must be followed, and in such States the mine operator, of course, has no choice. But in any case, the subject is of general interest and this report is presented with the object of discussing the various factors and considerations that affect the installation and effectiveness of each method. Accounts have been received from mining companies—some ventilating and others sealing mined areas. From these accounts, the Committee has prepared descriptions of two typical mining systems with sketches showing the sealing or ventilating method. In both cases the drawings are not projections of actual operations but are based on general procedures approved and accepted by the operators of each method.

Ventilating Mined Areas

One commonly recommended practice when ventilating mined areas is to provide adequate bleeding systems for all active working areas with as many outlets to the main returns as are necessary. With the provision of these outlets to the main returns it becomes a simple matter, in most instances, after an area is mined-out to ventilate it with return air from active areas which can travel through the mined areas from one set of main returns to another. If it is not possible to obtain air flow through such areas, then the return air at least sweeps past the edge of them, or an outlet to the main returns is provided for them. In this manner there is no build-up of pressure when barometric pressure drops suddenly.

Sealing Mined Areas

When sealing mined areas, seals are generally placed at the entrance to panel entries. Concrete stoppings of substantial construction are used. Pipes with valves are provided at the top and bottom of at least one seal in any area. The valves are opened and tested for water and gas at least once a week. No difficulties are encountered in sealing mined-out areas under average seam conditions.

In some mines, the panels on the intake side are sealed off and bleeder pipes are fitted into the stoppings and led over the intake entries to the return air course. In this way, any positive pressure caused by squeezes or further caving behind the seals forces any gas that might exist into the return air.

CONVEYOR MINING

Committee Chairman

A. E. LONG

METHODS OF BELT LOADING

R. U. JACKSON AND J. W. HARDY

IN transferring material from belt to belt, loading from shaker or chain conveyors, or direct loading from machines or shuttle cars, economy is the basic requirement. The ideal transfer method would be to have the stream of coal travel at the speed of the belt in the same direction . . . without drop or impact transfer to the belt, providing a perfectly even and uniform cross-sectional load on the belt without spillage. All of these factors cannot be obtained in practice, so a process of elimination must be made to incorporate as many of them as possible. This requires a number of considerations. Actual value of the conveyor belt must be known and its estimated normal life predetermined in order to evaluate the number of ideal conditions that can be eliminated; as each elimination will definitely reduce the life expectancy of the belt, thereby increasing cost per ton. This analysis must be balanced against other economic factors.

Shuttle cars loading directly onto a conveyor constitute one of the greater hazards to belt life. Surge loads cause turbulence, scuffing, impact damage, and spillage. Conveyor misalignment is caused by the shuttle car bumping the frame and by the impact of side-loading. A unit is definitely required to take the entire load of the shuttle car quickly and then gradually transfer this load uniformly at the proper rate to the belt conveyor. No such a device is yet in operation, although several designs are in progress.

With the load on the belt, the problem arises of transfer from one belt to another either "in-line" or at right angles. Although chutes for end or side loading have been developed and designed by each conveyor manufacturer, they will not meet all of the requirements of local conditions. Some of the best belt to belt transfers have been installed by the operator, using the recommendations of the manufacturer in making a field fabrication to suit his particular operation. A chute installation must be able to take a high percentage of coarse coal one minute and fine coal the next; wet coal one minute and dry coal the next.

A device that will meet most of these conditions is the transition speed-up conveyor. This can be a belt unit, with small terminal pulleys to minimize drop, possibly 15 ft long, placed parallel to and directly over the feed point of the main conveyor. It should have approximately the same speed as the main belt and should take all impact damage, center the load, start it in the proper direction and put it on the main belt at the proper speed. This type unit does need additional head room at the loading station. If conditions require taking down roof, then this cost must be weighed against the reduced belt cost, when using a transition conveyor, to determine its real value.

Increasing use of multiple belt conveyors gathering from several loading units indicates that layer-loading will be more extensively used than is now common with the prevalent full-belt loading by shuttle cars. Full-belt loading causes too high a percentage of down-time when the out-by shuttle cars or feeder belts are stopped because of a fully loaded belt inby. Layer-loading requires a regulated feeder that will only partially load the belt so that an out-by load can be placed on top of the partially loaded belt. Layer-loading will require additional regulating feeders with correspondingly less belt scuffing and impact damage to the belt.

MAN-TRIPS AND SUPPLY HAULAGE

R. W. STOREY, D. A. ZEGEER AND H. M. MEADOR

PURPOSE of this study is to outline a procedure to use in determining the haulage cost in a belt mine for handling man-trips and supplies. Three types of equipment are considered—track, rubber-tired, and belt reversing. Comparative costs are submitted covering investment, installation, maintenance, and operation but these are merely for illustration and in no way advocate one system over another. Because of the different travel time required for different haulage methods, the work time at the face and therefore the production would vary from one system to another. In fact, this would no doubt be a very important item in selecting the type of haulage for any given mine. However, in this study, the production is assumed to be uniform for all systems. Each report gives advantages of its equipment as follows:

Rubber-Tired Haulage can go practically anywhere in the mine since it doesn't need track. Supplies and repair parts can, if desired, be delivered right to the working face. For a thin seam, more usable height is available for rubber-tired equipment, since there is no rail. Absence of trolley wire overhead eliminates a hazard.

Track Haulage needs no charging station or battery maintenance. Locomotives can haul a bigger pay load and serve more sections. The trolley wire and track serve as additional power line conductors. For longer distances, men, supplies, and supervisors are transported in and out of the section in a shorter period of time.

Belt Reversing eliminates investment for locomotive, cars, jeeps, as well as the costs for maintaining this equipment and reduce power costs for haulage operation. No additional bottom or top brushing for a supply heading is necessary. Some advantages of belt reversal for transportation are not present if the room conveyor is replaced by a shuttle car. In that case, supplies would have to be rehandled.

In making a cost comparison of the three methods, the Committee assumes each supply haulage to be applied in a theoretical panel, 600 ft by 2500 ft. Service haulage from the face is by off-track equipment transporting to the conveyor system. The coal is assumed to have a height of 48 in. with a hard sandy shale top and a medium fire clay bottom which softens when wet. The panel contains 192,000 tons of recoverable coal at an 80 percent recovery rate. A two-shift operation with 10 men per shift producing 320 tpd and working 220 days per year would complete the panel in 2¾ yr.

Each report submits estimated haulage costs based on mining operations whose actual costs were adjusted to meet the specifications of the theoretical panel. The reports describe in detail how the figures are calculated and, in the summary below, it will be noted that the differences in the total cost of each method are due to the investment and maintenance costs of the equipment. For example, the investment for rubber-tired equipment for a panel is estimated at $8500 depreciated in five years; the track haulage equipment is $4730 depreciated in 10 years. The Committee wishes to emphasize that these figures are not the actual costs for any operating mine and in a panel with different specifications from those assumed here, the estimates might tell a different story.

RUBBER-TIRED HAULAGE COST

Investment—tractor, trailers	$0.045 per ton
Maintenance—labor	.022 per ton
Supplies	.018 per ton
Operating Cost—labor	.037 per ton
Total Haulage	$0.122 per ton

TRACK HAULAGE COST

Investment—locomotive—cars	$0.013 per ton
track—trolley	.012 per ton
Maintenance—labor	.014 per ton
supplies	.014 per ton
Operating Cost—labor	.032 per ton
Total Haulage	$0.085 per ton

BELT-REVERSING HAULAGE COST

Investment	$0.003 per ton
Maintenance	.004 per ton
Power	.002 per ton
Operating Cost—labor	.032 per ton
Total Haulage	$0.041 per ton

ROOF ACTION

Committee Chairman

GEORGE N. McLELLAN

METHODS OF ROOF SUPPORT

E. H. JENKS

CONSIDERABLE progress has been made in this study during the past year. As originally proposed, the purpose is to show under what roof conditions and for what services each type of support is best suited and is most economical. The time element is a primary factor and recovery of support materials is an important item. A data sheet, designed to develop the information needed in this study, has been sent to a number of coal operators. The report will deal only with a production panel and will not include main line or intermediate haulage entries. Data requested cover entry development, room mining, and pillar extraction, asking specifically for: (a) support material used; (b) size of support material; (c) spacing; (d) quantity used per cut; (e) man hours setting per cut; (f) length of time that each support is left in place; (g) quantity or percent recovered; and (h) man hours spent in recovery.

MAINTENANCE OF ROOF DRILLS AND BITS

D. E. INGERSOLL

ROOF bolting has been established as a practicable method with numerous benefits, but when the cost of bolting exceeds the cost of conventional methods of roof support the method defeats itself. While not widespread, drilling costs have made bolting expensive in a few places. One example has been reported where a carbide-tipped bit was completely destroyed in drilling a hole for one bolt.

It appears likely that any rock encountered in the coal measures can be successfully drilled by a rotary drill with carbide-tipped bit, since it has been demonstrated that rotary drilling can be done efficiently even in granite. The four chief independent variables are thrust or pressure on the bit, speed of rotation, type of bit and rock type.

For any given rock there is apparently an optimum thrust, speed of rotation and bit. As the thrust is increased the rate of penetration increases to a maximum (here the bit wear is at a minimum) and then begins to decrease. The maximum rate of penetration is reached at a lower thrust with a softer rock or with a slower speed of rotation. The harder the carbide tips of the bit the lower the thrust for maximum penetration rate.

Tests made (figures are given in the report) led to the following conclusions: (a) the efficiency of the rotary drill depends upon the thrust, the spindle speed and its power; (b) the optimum spindle speed ranges from 130 to 180 rpm; (c) the 1¼-hp drill is very much underpowered and the optimum power required is between three and five hp; (d) the optimum thrust, spindle speed and power depend on the nature of the rock; (e) with standard two-wing bits, the limit to thrust is 1500 lb. Above this the wings of the bit bend and twist. Above 1800 lb the wings are sheared off; and (f) standard two-wing bits must be confined to rocks of soft or medium hardness.

With the foregoing factors developed in research, it has been suggested that the following be presented as a technical approach to the problem: First, a drill (or drills) should be obtained which will provide adjustable thrust (about 100 to 4000 lb) and speed (about 50 to 1000 rpm) and a maximum torque high enough (150 ft-lb) to prevent stalling. With this drill, enough different rock types should be drilled to indicate the probable range over which the optimum thrust and speed may be expected to vary in coal mine work. This should be done using different types of bits in order to include the remaining variable. Based on this information, it will be possible (1) to specify the basic characteristics required of an efficient drill, and (2) to construct a chart giving (say) the optimum thrust for the various rocks depending on nominal drill speed.

EXTENDING ROTARY DRILLING TO HARDER STRATA

B. H. GOODRICH

BEGINNING in 1950, one company's Experimental and Research Department has been working on problems associated with rotary drilling of small holes. The art is already successful in Germany in shales adjacent to the coal beds and in this country at the U. S. Bureau of Mines at Rifle, Colo. Roof bolting is becoming more popular and the need for fast drilling of shales and sandy slates is of growing importance.

(The report submits and explains several graphs showing rotary pressure relationships and continues)

It can be safely said that there is no preferred rotation speed or bit thrust. Assuming that the time of drilling is important, the best thrust will be the maximum the rod and drill bit can withstand. Likewise, the best speed will be the fastest speed that will give an acceptable bit life in consideration of abrasive wear.

The success of rotary drilling in harder rock strata is limited by a lack of better cemented carbides and a lack of skill in their application. The mechanical features of bits can be examined and evaluated. In the past two years there have been conducted detailed tests to measure the effectiveness of such features as clearance angle, rake angles, radial rake and face angles of bits. While some of the results are not yet explainable, the value of a feature can be well measured.

What rocks can be rotary drilled? To answer this question the ideas of Dr. Hans Sievers of Germany have been expanded by building and perfecting a simple sensitive type drill press in which a given load is maintained on a bit and a constant number of revolutions are turned. By use of a small carbide bit, holes are drilled into the samples of rock to be investigated. The average depth of five holes so drilled is used as a measurement of drillability. By measuring the wear on this bit a useful indication of the relative abrasiveness of the rock can be had. By a correlation between these laboratory measurements of the test rig and the full-scale tests made in the laboratory in large blocks, an excellent measuring means has been developed. It is important to understand that none of the accepted scales of rock hardness or the physical measurements generally quoted for rock give a usable indication of drillability by rotary means.

GEOLOGIC PROBLEMS IN COAL MINE ROOF

AUREAL T. CROSS

IRRESPECTIVE of the original conditions of deposition, many sedimentary beds in coal mines are considerably altered in form, structure and strength by the various forces of nature which act upon them during the long periods of geologic time following their accumulation. Original conditions and peculiarities of the sediments may be retained as the sediments are consolidated but many types of alteration occur and new characteristics are introduced.

Most common of the phenomena resulting from earth pressure and movement are folding and faulting. Associated with these is the relatively common development of slickensides, shear planes and joints or cleat. Though actual movement may be slight, principally a unilateral oscillation, the importance is great for, in general, rocks deformed in this way lack the original adhesion between laminas and in addition may lack the original continuity between layers. The presence of resistant lenses or inclusions of strong rock in a zone of weaker shales may result in squeezing and twisting the shale away from the included mass, with the consequent distortion of all parts of the associated rock.

Other natural forces often act upon the roof rocks to change their character. Leaching of the cementing substance from between granules of a rock by percolating ground water may weaken the roof strata. Such a "rotten" "punky" or "friable" rock may have little lateral strength.

Some roof strata have a high percentage of clay minerals or pyrite and various mineral salts take up water or oxygen and swell disproportionately. Such swelling or oxidizing layers tend to drop off in massive slabs or "scale" down in sheety plates or fragments. The same condition is apt to prevail, if carbonized, remains of fossil leaves are abundant on the bedding planes or if there is a concentration of flake mica along the original bedding planes or laminations of the rock.

Complete information on geologic phenomena is of great importance to mining operations. Examination of the nature of roof conditions by competent geologists in connection with mining operations often results in more efficient control of roof problems. In some mines several basic types of roof sequences may exist. Each of these requires a different method of drilling, support, sealing, etc., or even a different mine layout. If such rock types and potential anomalies are determinable in advance of mining operations by a geologist, as they sometimes are, it may be possible by an integrated research program gradually to set up criteria for determining such features which could be interpreted and utilized by regular foremen in conjunction with or in advance of the mining cycle.

Five fundamental areas in which research is needed are outlined below. For each of these is suggested a possible course of action or specific problems to be solved.

(1) Fundamental types of sedimentation represented in roof rocks of coal mines.
(2) Deformation of roof strata.
(3) Deterioration of roof strata.
(4) Nature of strength of roof.
(5) Methods of determining conditions in advance.

SURFACE PREPARATION

Committee Chairman

T. W. GUY

PREPARATION PROBLEMS OF CONTINUOUS MINING

THE fact that the subject assigned deals specifically with *problems* arising from continuous mining that affect preparation plant operation and design, means that this discussion will be limited to the gloomy side of the picture and no attention given to the advantages of this mining system in respect to costs, etc. There are several problems arising from the use of continuous machines. However, they will be confined to three general categories; namely sizing, quality and cleaning characteristics. In order to include all phases, this subject is covered in three discussions, presenting the viewpoint of the mine operator, the manufacturer of coal cleaning equipment and the manufacturer of continuous machines.

OPERATOR'S VIEWPOINT

F. P. CALHOUN

A COMPARISON of the screen analysis of continuous and conventionally mined coal indicates an increase in the amount of fines produced and a decrease in the top size material. It appears that the split is near the one-in. size and that while there is less plus one-in. material in the continuous mined coal, the fraction from 1 to 1⅛ in. does not change appreciably. The general effect of greater amounts of fines is to decrease the capacity of the cleaning plant. This can be overcome by adding cleaning and drying units to the cleaning plant, resulting in increased costs due to capital, maintenance and in some instances,

operating labor. Plants that are designed to wet clean the entire product usually encounter trouble in the water-clarifying circuit due to increased amount of extreme fines in the plant feed. The result is more solids pumped to the silt pond until additional water-clarifying equipment can be installed.

In general, coal produced by a continuous mining machine is higher in ash and damper than coal from conventional mining. The added moisture is not true with all types of machines. Added ash in the raw coal comes from not being able to keep the cutting head in the coal seam at all times. The result is greater rejection in the coarse coal fraction. In the fine size the result is usually a poorer quality clean coal unless the cleaning equipment is efficient enough to remove all the impurities. If the impurities are removed and quality is not impaired, then the rejection becomes greater. Plants using air cleaning on fine coal are handicapped by the additional moisture as well as more impurities. This results in cleaning equipment becoming less efficient and a poorer quality product for market.

Although there have not been many data compiled on this subject, there is good reason to believe that a comparison of washability studies on coal mined by continuous and conventional machines would show that the coal from the continuous operation is easier to clean. This is due to the extra crushing or cutting of the coal and the reduction in size which always results in liberation of impurities and less near gravity material at the usual cleaning gravities.

THE VIEWPOINT OF THE MANUFACTURER OF CLEANING EQUIPMENT

J. L. WALKER, JR.

DUE to the great number of variables encountered in coal mining, it is impossible to predict accurately the changes in the characteristics of the product when contemplating a switch from conventional to continuous operation. No set of rules can be written that will hold true in all cases for differences in friability, inherent inert materials, cleavage characteristics, blasting techniques, degradation in transport from face to washer, and roof and bottom conditions. Yet all of these and probably many more affect the washer feed differences occurring between conventionally and continuously mined coal.

It has been stated that generally the amount of fines is increased by continuous mining, the degree of increase varying with conditions. An operator in the thick Freeport seam expects a 25 to 30 percent increase in his ¼-in. by 0 sizes. Pittsburgh seam operators experience a similar size change, while in the midwest, one operator reports no change in size consist.

If cleaning plant operating conditions are to be maintained and the *quality* of the raw coal remains unchanged, the solution of the problem simply involves installation of additional cleaning, drying and clarifying equipment. If the quality of the raw coal is changed, the problem becomes more complicated. If a wet table plant is suddenly burdened with an additional 10 percent of feed, it must be equipped with an additional 10 percent of capacity, if it is expected to achieve comparative washing results. It is the same with centrifugal and thermal dryers and sludge tanks, thickeners and filtering equipment.

There are expedients that can be followed to postpone the installation of large amounts of additional preparation equipment. First, the feed can be partially screened to maintain an equilibrium condition in the fine coal percentages, the screenings being loaded raw or stockpiled. Secondly, the plant bleed can be increased to purge the excess entrained solids from the system. If the percentage increase in fine coal is not too great, it can be absorbed in the system and the bleed regulated to maintain the circuit at a higher solids concentration thereby forsaking some plant cleaning efficiency, under the increased load. Finally, if the table section of the plant proves adequate, the aggravation being in the clarification circuit, it may be possible to reduce the percent of extreme fines reporting to the clarification equipment by either installing centrifugal dryers that will effect higher recovery rates or by treating the existing centrifugal dryer effluent as a separate entity.

The decrease in quality can only be coped with by more efficient cleaning processes. If the percent float in the reject remains constant, the total plant losses in clean coal increase as the amount of reject increases. If the extraneous material added by continuous mining is heavy gravity pyrites or slate, the float percentage in the reject may decrease thereby stabilizing the plant losses. However, too often a large proportion of the additional inerts is made up of high gravity ultra-fine (minus 325 mesh) floor clays which are next to impossible to remove from the plant with anything but pumps.

THE VIEWPOINT OF THE MANUFACTURER OF CONTINUOUS MACHINES

A. LEE BARRETT

SIZE consist of coal from continuous mining varies widely as a result of several factors. One of the predominant factors involved is the characteristics of the seam. It is evident that different size distributions could be expected when one considers the wide range of coal characteristics between the Pocahontas and the Miller seams, as compared to the Pittsburgh, and very strong tenacious seams such as the Illinois No. 6 or the High Splint seams of Kentucky. Another factor in determining coal size is the weight where pillar extraction is practiced.

A considerable amount of work has been done with respect to chain lacing, head arrangements and speeds in an attempt to improve coal size. Unfortunately, it

Generally, continuous mining means an increased load on fine coal cleaning facilities

does not appear that a great deal can be done in this direction. The future approach to this problem apparently must come from completely different designs and within the next few years there will be significant improvements in coal size as a result of the experimenting that will be done. It would, of course, be dangerous for preparation plans to be based on future possibilities; consequently, it is felt that current plant design must be based on current mining characteristics.

In some instances moisture has presented significant problems. Coal seams are highly variable in their tendencies to make dust. Adequate control has been realized in the dustiest seams by the addition of approximately 4 percent of moisture with high pressure sprays. In other operations it has been possible to cut down the quantity of water to as little as 1 percent.

Development has been going on for some years toward dry dust control. It is indicated that small, portable, relatively inexpensive devices will soon be available, which will provide a high and satisfactory degree of dust removal. There still seems to be a question, however, as to whether State, Union and Federal dust requirements in general will require spraying; if so, the coal will still arrive at the tipple in a moist condition.

Ash content is another factor which is variable, depending on seam conditions. The worst situation is in low coal where the machine operator tends to take top, bottom, or both. In other seams, he may mine the top or bottom accidentally or through carelessness. Considerable work has been done on automatic or visible controls which would notify the operator or prevent him from mining in the top or bottom. Technically, these controls have been developed but most of them involve considerable gadgetry and operating reliability is not as good as might be desired. If there is inconvenience or effort of any kind involved in top and bottom limit controls, the operator has a strong tendency to completely ignore them. It is likely that this situation will continue to exist.

MECHANICAL LOADING

Committee Chairman

H. A. JONES

MAINTENANCE OF CONTINUOUS MINING EQUIPMENT

W. J. SHIELDS

THE purpose of this study is to show cost of labor and material required to maintain continuous mining machines. It is not concerned with the unit machine tonnage, the man tonnage, the overall operating cost, nor any information which might be considered confidential. The primary objectives are:

(1) To develop factual data on cost of maintenance in labor and material.
(2) To compare such data with the same information for parallel operation with conventional equipment under the same physical conditions.
(3) To improve methods of training operating and maintenance personnel in the handling, care and repair of continuous mining equipment.
(4) To assist in setting up a practical, scheduled maintenance program.
(5) To accomplish better design, workmanship and materials in equipment based upon weaknesses developed during actual operation.
(6) To promote some degree of standardization of motors, pumps, controls, hydraulic hose, fittings and other parts and to consider the accessibility for replacement of rapidly wearing parts.
(7) To establish a method for making time studies of machine delays and contributing mine delays.

The Committee proposes a form to report on a continuous mining section; one part to show "Continuous Machine Delays," and the other to show "Delays on Section." Total delays that occur on the machine are to be classified under nine items: Service Haulage, Main Line, Transportation, Cables and Power, Roof Control, Ventilation, Supplies, Auxiliary Equipment and Water Supply System.

Cost of maintenance material and labor should be related to tonnage of material produced over a specified period and divided into the following three groups, each classified under the same headings as proposed above for reporting machine delays:

(1) Material and labor for on-shift maintenance
(2) Material and labor for between shift maintenance
(3) Material and labor for rebuilding, general overhaul or replacement

SERVICE HAULAGE FOR CONTINUOUS MINING

FRANK R. ZACHAR

SERVICE haulage is recognized as one of the keys to the successful operation of continuous mining and a solution to this problem must be found before the expected tonnages can be produced by continuous machines. In making a study of this subject, the Committee has gathered accounts showing how various types of haulage equipment are being used by 33 mines in principal coal fields as follows: northern West Virginia, 8; southern West Virginia, 1; Ohio and West Virginia Panhandle, 5; western Pennsylvania, 11; central Pennsylvania, 5; Illinois, 2; and eastern Kentucky, 1. Each of these mines has furnished details of the seam, the mining plan, timbering and service haulage method. "Mine A" as given below will illustrate the type of data that has been furnished.

Mine A

Seam and Conditions: The Sewickley Seam—72 in. overall height, 66 in. mining height—is fairly soft with some sulphur intrusions in the top 36 in. The roof is hard shale, very good in some areas, but other areas require timber and/or roof bolts. At times the draw slate falls as coal is removed. The bottom is soft fire clay and six in. of coal is left. Shuttle car roadways generally are rutted.

Mining Plan: Block system developed with five entries 19 ft wide on 70 by 70 ft centers. Entry pillars and panel barriers are extracted on retreat. Area recovery is 85 to 90 percent.

Timbering: Roof jacks are sufficient on advance. Roof jacks, posts and some cribs on retreat. No roof bolting as yet.

Transportation: The continuous machine discharges onto the mine floor, where the coal is picked up by a mechanical loader and put into shuttle cars which load into mine cars. Two or three shuttle cars are used. The pick-up loaders were on hand but are necessary for cleanup and also because the continuous machines won't load the shuttle car to capacity. Need continuous transportation system though unable to see how cleanup can be worked without pick-up loader. Management feels that an 80 percent tonnage increase is possible with improved system.

Following descriptions of each of the 33 mines reporting general conditions and operating practices are summarized for the 33 mines, giving particular attention to the haulage methods. It should be mentioned that the operators who submitted these accounts are almost unanimous in saying that the haulage methods they use are the best they have been able to devise with the equipment available. However, they seem equally unanimous in recommending further research and experiment that will result in higher production from a continuous operation.

HAULAGE ROADS

Committee Chairman

JAMES D. REILLY

STANDARDS FOR HEAVY RAIL TURNOUTS

J. E. ELKIN

STANDARDS for frogs, switches and turnouts for coal mine tracks were formulated by this committee and accepted by the American Standards Association in 1934. Those specifications have been widely adopted by manufacturers of rail and track accessories so that today all the various parts of a mine track turnout have standard dimensions and are interchangeable. The present standards cover up to 80-lb rail. This has proved adequate so far, but increasingly heavy equipment underground—large capacity cars and high speed trips—indicates a need for heavier track construction.

Anticipating this trend, a study on standards for 85, 90 and 100-lb turnouts was started about a year ago by a subcommittee of manufacturers and operators who are thoroughly conversant with all phases of track operation. Four drawings showing frogs and switches for 70 to 100-lb rail have been completed; bolted frogs by J. B. Haskell, cast steel frogs by E. E. Roecher; and split switches (7 ft 6 in. and 10 ft) by C. F. Meyer. These have been approved by the Committee and will be submitted to the coal industry as a tentative proposal. Manufacturers and users of haulage equipment will be asked to submit comments and suggestions.

If no objections are offered the new specifications will be included in the next publication by the AMERICAN MINING CONGRESS of the booklet, "Construction and Maintenance of Haulage Roads in Coal Mines."

DETERMINATION OF PROPER MINE CAR CAPACITY

J. D. REILLY AND D. A. ZEGEER

THE purpose of this study is to evaluate factors that determine the most economical design and capacity for mine cars to suit given sets of seam and operating conditions. The committee plans to base its study on actual data furnished by coal companies and two accounts have been submitted.

25-Ton Mine Cars

A new mine was planned to operate the first 10 years by contour mining with belts hauling the coal to the outside and loading into mine cars. A detailed study was made to determine the proper size mine car for the main haulage. For this particular operation the 25-ton cars proved to be most economical. This mine produces 3300 tons of raw coal, 3000 tons of clean coal in a three-shift operation. A 20-ton tandem locomotive hauls at a speed of 15 mph. The cars have eight-wheel trucks and weigh 10.5 tons. With a load of 25 tons this gives a live-load ratio of 2.38 to 1. The cost of car per cubic foot capacity (level full) is $3290/888, or $3.70. A detailed cost summary is as follows:

Investment—rolling stock, track, wiring	$51,801 per year
Operating and maintenance labor	77,339 per year
Operating and maintenance supplies	13,640 per year
Power	7,740 per year
Total annual haulage cost	$150,520 per year
Cost per raw ton (733,000)	$0.205
Cost per raw ton-mile	0.058

10-Ton Mine Cars

This operation produces 2600 tons of clean coal per shift plus 40 percent reject. The cars are loaded at the face by loading machine and dumped at the tipple by rotary dump. The main line trips have a speed of 14 mph hauled by a 26-ton locomotive. The car has eight-wheel trucks and weighs 3.75 tons. With a load of 10 tons, the live-load ratio is 2.66 to 1. The cost per cubic foot of capacity is $4.41.

Initial investment, based on September, 1953, prices, is as follows: 190 cars at $1,500 each; 26-ton differential main-line locomotives @ $47,000 each; eight-ton sectional motors @ $14,000 each and the 13-ton gathering locomotives @ $17,000 each. The one-car rotary dump would cost approximately $60,000 to install today.

Main-line track initial investment is based on a cost of $5.39 per foot which includes all labor, track, ties, spikes, bonds, etc. The wire cost is $1.33 per foot which includes all labor and the wire, hangers, clamps, etc. In timbering, a figure of 2.37 per foot was used which includes all labor. The grand total per foot of main line is $9.09. A detailed cost summary shows the following:

Total Operating Cost	$0.0170	per ton-mile
Maintenance Cost	.0071	per ton-mile
Power Cost	.0024	per ton-mile
Depreciation Cost	.0159	per ton-mile
OAB Compensation, etc.	.0015	per ton-mile
Total haulage cost	$0.0439	per ton-mile

The well attended meeting occasioned much thought and discussion

Operators Corner

A Better Multi-purpose Grease

By ROGER B. WHITE
Standard Oil Co. (Indiana)

ONE of the serious questions in lubrication of mining machinery has always been "which grease should I use?" In the past, the mine maintenance man had to keep many different greases on hand to take care of the variety of difficult lubrication jobs found around the mine. More recently, research uncovered another approach to the lubrication problem —multi-purpose greases.

These multi-purpose greases were designed so they could be used under conditions typical of mining. Lithium type multi-purpose greases, in particular, were characterized by their ability to stay in bearings, to seal out dirt and to resist the washing action of water.

Now, lithium multi-purpose greases may contain a new research-developed additive which increases their ability to resist extremely high bearing loads. Called an extreme pressure characteristic, it permits better lubrication of certain bearings where high unit pressures and excessive rubbing occur.

The new lithium grease is particularly well-suited for lubricating strip-mining equipment. Sheave bearings on booms of shovels or draglines are a good example. They have always been tough to lubricate. The new lithium grease cuts down on excessive wear and friction, and reduces troubles caused by overheating—an important safety factor in maintenance. Lubrication of tipple dryer equipment, exposed to high temperature, moisture and dust, has also been a serious problem, and the new grease is especially valuable in such. Conveyor, pulverizer, crusher bearings and many other applications where a multi-purpose grease of great load-carrying capacity is needed have all benefited by using the new grease.

In underground mining, this new lithium grease has proved successful in lubricating electric motor bearings, shuttle car wheels and other grease-lubricated anti-friction bearings.

Use Heavier Base Oil

The new grease is an improvement over former lithium greases in two respects: a much heavier base oil is used and extreme pressure agents have been added. Both improvements contribute to better performance under severe operating conditions. The heavier base oil improves both the "staying" quality of the grease and its load-carrying ability. The extreme pressure additive used in so effective that the grease will meet a minimum Timken* EP value of 33 lb. One precaution to be observed in the use of a heavier base oil, however, is that the use of the new grease in extremely low temperature applications is somewhat restricted. The new grease has a consistency well adapted for use in dispensing equipment, both hand and automatic.

In general, lithium type greases with added EP characteristics are well adapted for most conditions found in mining operations. It is an all-weather product for hot or cold, wet or dry conditions. It is particularly desirable where lubrication conditions are severe. Mining maintenance men should investigate the new product to see if their lubrication can be more effectively handled.

* Timken test for evaluating extreme pressure characteristics.

Better greases have been developed for high temperature service such as lubricating coal dryers

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- You need only one tool—a *socket wrench!*
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Cooling Plants for Underground Workings

(Continued from page 54)

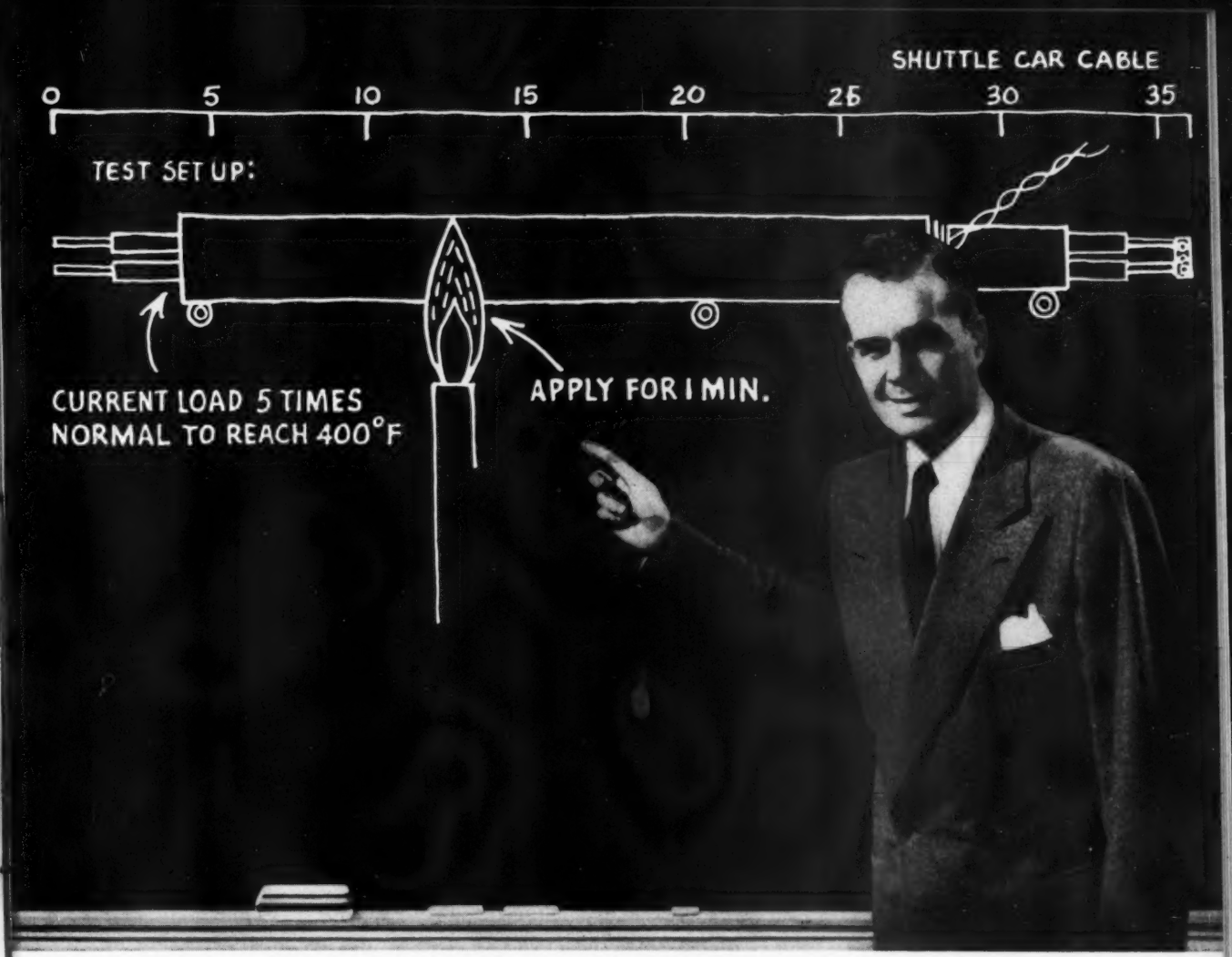
doing this has been gained from measurements of pressure losses carried out on a scale model by the Société des Charbonnages de Gosson, La Haye, et Horloz Réunis. The model represented a shaft 3.50 m or approximately 10.5 ft in diam, made to the scale of 0.8; the total length of the model was 102 m or 334.56 ft. Great care was taken to reproduce the irregularities of cross-section, the misalignment of the cross beams and the roughness of the walls usually found in shafts. The tables in Fig. 2 show the results of these tests, expressing the pressure losses S in mm of water and the power W in HP necessary to compensate these pressure losses, in a shaft 3.5 m (10.5 ft) in diam and 1000 m (3280 ft) deep, with an airflow of 50 cu m/sec (106,000 cfm).

An examination of the results shows, in the first instance, that these pressure losses vary considerably according to the type of equipment used, the two extremes being in the ratio of 1 to 12.8.

In addition to this, if the coefficient of pressure loss is calculated, considering the shaft as divided into a number of parallel passages by the cross beams, partitions, etc., the value obtained is in the region of that which holds good in a rectilinear roadway with timber sets. Consequently, it is clear from this that the arrangement of the cross beams or partitions at regular intervals of 3 or 6 m (9.8 or 19.6 ft) produces an effect which is similar, from the aerodynamic point of view, to that of a very rough wall; it is therefore always advantageous to join these cross beams by means of a smooth wall. For the same perimeter, the pressure losses in a section bounded by cross beams from 3 to 6 m (9.8 to 19.6 ft) apart are 5.8 times as high as the pressure losses for the same section bounded by a smooth wall.

The conclusions just quoted have been confirmed by direct measurements of pressure losses in two shafts at the Charbonnages du Bois-du-Cazier. The pressure losses calculated on the basis of the above-described small-scale tests were 20 percent higher than those obtained by direct measurement, but, in this instance the cross beams were not so far apart and were better aligned.

It is, therefore, clear that, generally speaking, it is possible to obtain an appreciable improvement in the ventilation by fitting out the shaft in a suitable manner. The lining of the intake airways can also have a considerable effect on the pressure losses which occur in the ventilation circuit.



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NEW FEATURES GIVE CABLE STAMINA

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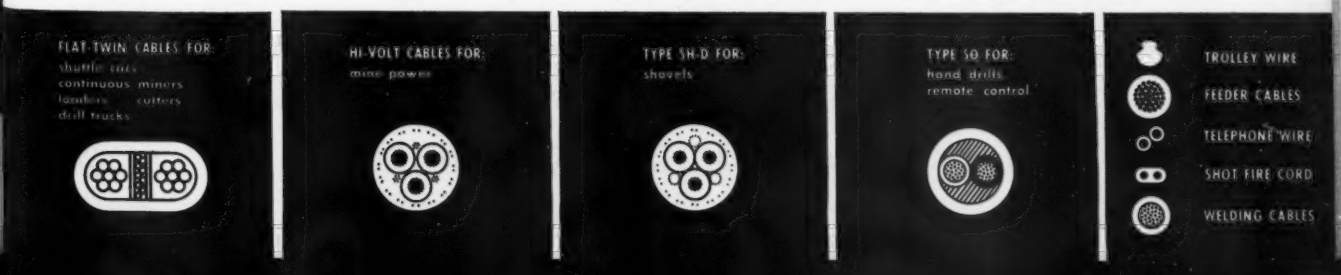

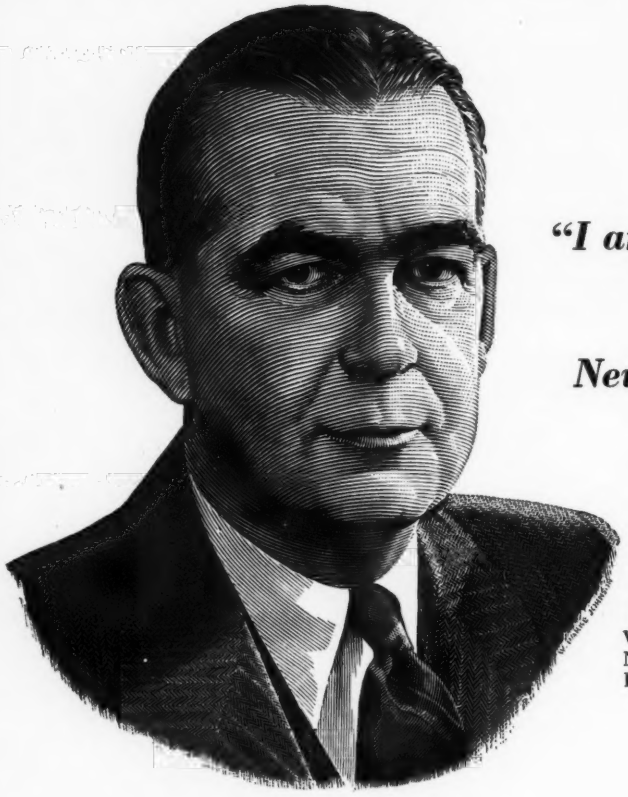

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Wheels of GOVERNMENT

AMC

As Viewed by HARRY L. MOFFETT of the American Mining Congress

ADMINISTRATION leaders, both in Congress and in the Executive Branch of the Government, are busily engaged in whipping plans into shape for the 1954 Congressional session. The President is meeting with his Capitol Hill lieutenants to draw up a legislative program that may meet with Congressional acceptance. Any program adopted, however, is likely to be fraught with controversial issues that will require coalition action if it is to be enacted.

One thing is certain—Congress at the coming session will be laboring under a staggering load. Heavy pressure from constituents for action on domestic problems, and the relatively short time before the 1954 campaigns will be in full swing, impose upon the national lawmakers the burden of making a substantial "record" in 1954. Informal agreements already exist to get Congress down to work right away, and to keep grinding out the legislative grist despite the call to the hustings in this election year.

The tentative agenda calls for legislation approving the St. Lawrence Seaway, a $15 billion increase in the Federal debt limit, tax revision, deferment of the January 1 increase in Social Security payroll taxes, expansion of Social Security coverage, statehood for Hawaii, tariff law extension, Taft-Hartley Act revision, and farm price supports. Each one of these proposals faces stiff opposition and will be fought every inch of the way by its opponents.

Labor Law Revision

Battle lines are again being drawn for consideration of amendments to the Taft-Hartley Act. Unions have reiterated their stand that the law should be repealed, with a return to the Wagner Act as their goal.

The Administration has indicated that the President's State of the Union message will contain recommendations for revising the Act "to promote sound and peaceful industrial relationships."

Industrial organizations throughout the country have begun to become vocal in calling for shoring up of the Act to make it more equitable and to prevent its misuse by powerful labor union heads.

Some hint of the Administration's position, although even this is not too tangible, was given by the new Secretary of Labor, James P. Mitchell, in a speech before the CIO. He told that gathering, which went on record for repeal of the Act, that he does not favor its repeal, and that he would oppose any proposals designed to (1) leave the Government powerless to deal with national emergency strikes, (2) make it easier for Communists or racketeers to control labor organizations, (3) encourage unions or their officials to be irresponsible, (4) permit employers to escape their obligation to bargain collectively, and (5) make Federal law a device for breaking unions or having an undeserved punitive effect upon anyone. Mitchell said that he would favor any amendment to the law which would minimize the amount of Government intervention in labor disputes.

Since the recommendations of the Labor Department are likely to be given considerable weight at the White House, most observers feel that any proposals submitted to Congress in January will encompass suggestions favoring relaxation of T-H provisions with a view to soothing labor organizations.

On Capitol Hill, there are widely divergent views as to the prospects for Congressional action. On the House side, Chairman McConnell of the Labor Committee has predicted that legislation will probably be enacted early in the next session. Rep. Graham Barden, ranking minority member of the committee, however, has declared that prospects for any action are very dim because of the forthcoming elections. On the Senate side a subcommittee of the Labor Committee, headed by Senator Ives of New York, will be responsible for steering Taft-Hartley amendments through that body. Prospects are for at least brief hearings by both committees on any proposals submitted by the White House.

Washington Highlights

LABOR LAW: Administration Seeks Revision.
TAX REVISION: Omnibus Bill in Mill.
TARIFF: Controversy Looms in 1954.
MINERALS POLICY: In Development Stage.
DEFENSE MATERIALS: Advisory Group Formed.
PUBLIC LANDS: To Private Ownership?
DMEA PROGRAM: Revised.

Technical Tax Revision in Making

Strictest secrecy surrounds the drafting of a "technical revisions" tax measure now under way. Treasury and Congressional experts are said to be in the final stages of shaping an omnibus measure that will make a host of changes in present revenue laws and afford tax relief to both individual and corporate taxpayers.

The extent to which relief will be voted by Congress will depend largely on the views of top Administration officials as to where revenues can be slashed without harm to the nation's financial position. Tax concessions in the omnibus measure will be over and above those that taxpayers are scheduled to get beginning next year—the 10 percent cut in individual income taxes, a reduction in the 52 percent rate for corporations, and removal of the excess profits tax next April 30.

Leading members of the tax-writing committees of both House and Senate favor the overhauling of the revenue laws at the next session, and are predicting that some such legislation will reach the President's desk.

Under present plans the entire Internal Revenue Code would be repealed and a new code substituted. According to press reports, changes

would be made in every section of the present code. These reports also hold that tentative decisions have been reached to bring about major tax relief along the following lines: relief from double taxation of dividends, an easing of depreciation policies, elimination of the need for millions of taxpayers to file declarations of estimated tax liability, and more liberal deductions for medical expenses.

Meanwhile, there is considerable controversy over whether or not the scheduled January 1 increase in the Social Security tax, from 1½ to 2 percent on both employers and employes, should be permitted to go into effect. Last May the President urged Congress to postpone this boost for another year, but the lawmakers refused to act on his request. Powerful members of the House Ways and Means Committee, including Chairman Dan Reed and Rep. Carl Curtis, oppose any deferment of the increase declaring that it is necessary to maintain an adequate reserve in the Social Security Fund.

Other influential Congressmen, including Reps. Richard M. Simpson and Charles T. Halleck, want early approval of the President's request. A number of key leaders on Capitol Hill have pointed out that the increase in the Social Security tax would largely offset the scheduled reduction in individual income tax rates, particularly in the low income brackets.

Tariff Hearings Conclude

Hearings before the U. S. Tariff Commission on "escape clause" relief for the domestic lead and zinc mining industries have concluded and the Commission is reviewing the testimony in preparation for making its recommendations to the President next year.

More than 15 spokesmen for the industry, including the American Mining Congress and several Congressmen, outlined the depressed conditions existing in the industry and called for increased tariffs. The Commission was told that a flood of imports has demoralized the lead-zinc mining industry and that serious curtailment has taken place in the domestic production of these metals.

Representatives of the Canadian mining industry and of consumers opposed any further hikes in existing tariffs.

Meanwhile, the Governors of the 11 Western States called upon the Tariff Commission and on Congress for action to relieve the distressed condition of the domestic lead-zinc industry. They also called for action to protect domestic producers of other minerals essential to U. S. defense from excessive foreign imports.

No word has yet come from the President's Commission studying our foreign trade policy as to what recommendations will be made to Congress. A number of industrial and labor organizations have charged that the Commission is not conducting its study impartially, and that the emphasis has been put on loosening up our tariffs rather than seeking to protect depressed American industry.

The subject of revising the Trade Agreements Act is likely to be a "hot" one at the next session.

Mineral Self-Sufficiency Studied

Hearings continue before the Minerals, Materials and Fuels Economic Subcommittee, headed by Senator George Malone of Nevada, on its investigation into the minerals self-sufficiency of the United States.

Malone's committee has held hearings in Seattle, Salt Lake City, Los Angeles and Washington in an effort to determine the extent of minerals reserves in the Western Hemisphere and particularly in the United States, with emphasis on possible self-support in the event of a hot war.

During these hearings the committee has assembled a mass of data dealing with most of the major metals and minerals, coal and other fuels.

When the study is completed, it is expected that a detailed report will be made to Congress on the Committee's findings and that legislation may be recommended dealing with national minerals policy.

Meanwhile, the Cabinet Committee headed by Interior Secretary McKay, which is to come up with recommendations for a national minerals policy, has settled down to intensive work. Mining men from all branches of the mineral industries have been called upon to assist the Interior and Commerce Departments in their efforts to bring out a policy that will be acceptable both to Government and to industry. Sparkplugging the program is Interior's Assistant Secretary for mining, Felix Wormser.

Materials Advisory Group Formed

ODM Director Arthur Flemming has established an Interdepartmental Materials Advisory Committee within the Office of Defense Mobilization to develop policies, plans and programs relating to defense materials. Included among matters to be handled by the group are the stockpiling of strategic and critical materials, the content of defense materials programs, and development of new programs to improve the U. S. supply of defense materials.

The committee consists of the ODM Assistant Director for Materials, Elmer H. Weaver (chairman), and a representative from each of the following departments and agencies: Agriculture, Commerce, Defense, Interior and State Departments; Foreign Operations Administration, and the General Services Administration.

McKay on Lands Policy

Interior Secretary McKay, in a recent address to Western States Governors, said that the desired goal in the administration of the public domain is to provide and make accessible to the private economy, basic resources for economic activity, and that public ownership of land and resources is not an end in itself. He emphasized that the Government is "not giving anything away" but is attempting to get proper utilization of the lands by private enterprise and to provide a sound foundation for a strong economy.

The Secretary plainly indicated that while some lands must be retained under Federal ownership, the ultimate aim of the Administration is to constantly narrow the Federal land base by turning lands over to private hands.

DMEA Program Revised

Regulations of the Defense Minerals Exploration Administration have been amended to restrict the program to those minerals still in shortest supply and to reduce the maximum percentage of Government participation.

Government assistance remains available for the following metals and minerals: Group A, for which the Government will contribute 50 percent of the approved project costs—chromium, copper, and molybdenum; and Group B, for which the Government will contribute 75 percent of approved costs—asbestos (chrysotile only), beryl, cobalt, columbium, manganese, mica (muscovite block and film only), nickel, platinum, tantalum, tungsten, and uranium.

The practical effect of the amendment is (1) to eliminate crocidolite and amosite types of asbestos, refractory grade bauxite, industrial diamonds, and thorium from the list of minerals previously eligible for Government assistance, and (2) to shift all remaining commodities heretofore eligible for 90 percent Government participation into the 75 percent category, which previously included only manganese and tungsten.

The reduction in the percentage of Government participation for all metals and minerals listed under Group B now applies only to those applications received after November 3, 1953.

AMC Personals

Leo F. Reinartz, Armco Steel Co. vice-president, will serve as president of the American Institute of Mining and Metallurgical Engineers in 1954. He succeeds **Andrew Fletcher,** president of the St. Joseph Lead Co. In addition to Mr. Reinartz, two new vice-presidents have been elected, **Theodore Benton Counselman,** manager of FluoSolids sales for The Dorr Co., and **Harold Decker,** president of the Houston Oil Co. of Texas, who will take office early next year. Newly elected directors are **E. C. Babson, George D. Dub, Ralph E. Kirk, Carleton C. Long, Earl Robert Marble,** and **Philip J. Shenon.**

L. F. Reinartz

H. DeWitt Smith will also serve as a director of the institute for 1954. He has been designated president-elect for 1954 and will take office as president in 1955. Smith is a member of the Board of Directors of Newmont Mining Corp. All new officers will take office during the A.I.M.E. annual meeting in New York City, February 15 to 18, 1954.

H. D. Smith

J. Walter Hurley, veteran of 40 years in coal mining and formerly general superintendent for C. H. Mead Coal Co. mines at East Gulf, W. Va., has been elected vice-president in charge of production of North American Coal & Dock Co., a subsidiary of North American Coal Corp.

A number of other changes in the organization of North American Coal Corp. properties were made following the resignation of **A. J. Ruffini,** executive vice-president of North American. **E. F. Maurer,** formerly general manager of Powhatan deep mines, is now vice-president in charge of production of Powhatan Mining Co. **Roy W. Fox,** general superintendent of Powhatan deep mines, was appointed consulting engineer for North American Coal Corp. and its subsidiaries. **C. G. Evans,** formerly general superintendent of Red Parrot Coal Co. mines, has been named personnel manager of North American Coal and its subsidiaries, with headquarters in Cleveland. **Robert A. Maurer** was employed as assistant to the president of North American Coal Corp. **Emmett T. Lang,** formerly industrial engineer for Powhatan Mining Co., was appointed efficiency engineer for North American Coal Corp. and its subsidiaries.

Richard A. Young has been elected to the Board of Directors of the American Zinc, Lead and Smelting Co. to fill the vacancy caused by the recent death of Frank Bailey.

Young has been in the employ of the company since 1938. He spent the greater part of that time at Dumas, Tex., where he was resident manager and vice-president of the American Zinc Co. of Illinois, a wholly owned subsidiary of the American Zinc, Lead and Smelting Co. Since 1950 he has been vice-president of the parent company.

Harry A. Quenon, division manager for Eastern Gas and Fuel Associates, has been elected president of the West Virginia Coal Mining Institute, succeeding **Arch J. Alexander,** former state mines chief.

R. N. Holme is now employed as an industrial engineer by the Titanium Metals Corp. of America at Henderson, Nev. Formerly with Phelps Dodge Corp., Holme is in the technical department in charge of engineering for the magnesium recovery division of Titanium Metals Corp.

Leonard J. Timms has been named assistant to the vice-president of New River & Pocahontas Consolidated Coal Co. The company operates the Minden, Layland and Kaymoor mines in Fayette County, W. Va. Timms formerly was assistant to the president of Premier Pocahontas Co. and Eastern Coal Corp.

Shareholders of the Chewelah Copper Co. at a recent special meeting voted to increase the number of directors from five to seven. Directors elected were **John A. Peterson, J. W. Gilmore, J. R. Wigen, John Burch, E. P. Maher, Gordon LaVigne** and **Philip Skok.**

Two promotions in the Susquehanna Collieries Division of the M. A. Hanna Co. have been announced by C. A. Gibbons, vice-president and general manager. **W. H. Moore,** who has been superintendent of the Glen Lyon colliery, will become general superintendent of mines for the Susquehanna Division. **Michael F. Farrell,** assistant superintendent of No. 7 Colliery Section, succeeds Moore as superintendent of Glen Lyon.

Robert S. MacFarlane, president, Northern Pacific Railway Co., and **James Albert Woods,** president, Commercial Solvents Corp., were elected directors of the American Smelting and Refining Co. at a board meeting November 24 in New York City.

William B. Young, Bureau of Mines fuels technologist, left early in November for Cali, Colombia, on a two-year assignment for the Foreign Operations Administration. He will serve as mining consultant to the United States Embassy and as technical advisor to Colombian government agencies in the development of its coal industry.

Before joining the Defense Solid Fuels Administration in 1951, Young was employed by the United States Steel Corp. and Eastern Gas and Fuel Associates.

George F. Reed, formerly of Kingman, Ariz., is now general superintendent of the Black Rock mine in Bishop, Calif.

At the University of Illinois college of engineering, **George B. Clark** has been advanced to professor of mining and metallurgy and **John W. Marx** to associate professor.

E. M. Platts, one of the best known men in the mining machinery business, and executive vice-president of Joy Manufacturing Co. for several years, has been obliged to resign his position because of failing eyesight. He will continue to serve the company, having been employed by Joy as a consultant to its executives and Board of Directors.

The board of directors of Haile Mines, Inc., recently appointed three directors. They are: **K. C. Li,** chairman of the Wah Chang Corp.; **Hugh W. Darling,** of the law firm of Guthrie, Darling and Shattuck, Los Angeles, and **Carlton D. Hulin,** formerly head of the Geology Department of the University of California and a consultant, who has guided the company's subsidiary Tungsten Mining Corp.'s development.

Edwin L. Willson, Director of Research for the Lehigh Navigation Coal Co., retired October 31 to set up his own business as fuel engineering consultant. He had been with Lehigh since 1928.

Willson holds patents for an electrically heated rotary furnace and both a method and apparatus for carbonizing coal briquettes. He served as Regional Representative of the Solid Fuel Administration for War during the Second World War. He will establish his office as fuel engineering consultant at 1218 Walnut St., Philadelphia.

DeWitt L. Morris has been appointed superintendent of Freeport Sulphur Co.'s new mining plant at Garden Island Bay in the Louisiana marshland, it has been announced by vice-president Edmund D. Wingfield.

Morris joined Freeport in 1937 as a design engineer. He had an active part in the construction of the Garden Island Bay plant and the "floating" plant at Bay Ste. Elaine, La.

Paul L. Bybee, former production superintendent at Freeport's Hoskins Mound mine in Texas, has assumed the same duties at Garden Island Bay. He joined Freeport in 1942.

Carl Lee, chief engineer, Peabody Coal Co., retired on October 1 after 40 years with that company. During these years his principal interest has been the design, engineering and application of more efficient labor-saving devices. He has taken an active part in the advance of coal mining from back-breaking, dangerous, hard labor to the point it has reached today when coal is simultaneously cut and loaded by machine. He has announced that after October 1 he will be at leisure at his home, 9849 S. Hoyne Ave., Chicago 43, Ill.

Howard P. Clarke, Duluth, has been elected assistant secretary of United States Steel Corp., assigned to Oliver Iron Mining Division, R. T. Elstad, president, has announced. Clarke succeeds **Albert R. Morton,** who retired October 31, after more than 33 years of U. S. Steel service.

Elstad also announced the appointment of **Fred R. Strasser** as tax supervisor, Oliver Iron Mining Division, to succeed **John M. Good,** recently transferred to U. S. Steel's Pittsburgh general offices.

Charles F. Parker, Jr., has been elected president of the New Idria Mining & Chemical Co. Formerly vice-president and general manager of Telluride Mines, Inc., he has also been associated with American Metal Co., Climax Molybdenum Co. and Magma Copper Co.

— *Obituaries* —

E. S. Hamilton, 59, general superintendent of mines, for the Norfolk and Western Railway Co., died on October 30, 1953, at his home in Sarasota, Fla., after an illness of several months. Mr. Hamilton had been associated with the Norfolk and Western Mining Department in various capacities since coming with the company in 1923, and headed the Mining Department from August, 1952, until his death. He was widely known in the coal industry and was active in various mining associations.

Daniel Reese Gittinger, 59, a metallurgist for the Bunker Hill & Sullivan Mining & Concentrating Co., died October 16.

Carl Scholz, 81, a well known and widely recognized mining engineer, died in Charleston, W. Va., in early November.

A native of Germany, Mr. Scholz came to the United States in 1889 and entered the mining industry in Charleston. From 1902 to 1923 he was manager of coal mining operations for the Rock Island and the Chicago, Burlington and Quincy railroads in Chicago. During the last 25 years he had served as a consulting engineer for a number of leading coal companies, including Raleigh Wyoming Coal Co., Carbon Fuel Co., and Elk River Coal & Lumber Co.

In addition to his many other activities, Mr. Scholz served as president of the American Mining Congress from 1914 until 1917 and was a life member of that organization.

Emmett Henry McFarland, vice-president and general manager of the Freeport Sulphur Co., died in New Orleans on October 24. Mr. McFarland joined the Freeport Sulphur Co. as an engineer in 1925 at the company's Hoskins Mound plant near Freeport. He became a lift foreman in 1928 and was named superintendent of production at Bryan Mound in 1930. He later served in the same capacity at Hoskins Mound before becoming superintendent at Freeport in 1933.

In May, 1947, Mr. McFarland became assistant general manager in New Orleans and then general manager in January, 1949. He had been vice-president and general manager since October, 1950.

John Rikard Pearson, 71, died at Richfield, Utah. He was formerly superintendent of the Deer Trail Mining Co.

H. B. Burrell, director of raw materials development for United States Steel Corp. at San Francisco, died in Pittsburgh, Pa., November 9. Mr. Burrell, 49, was one of the discoverers of the Venezuelan iron ore fields.

Richard Maize, 77, secretary of the Pennsylvania Department of Mines from 1940 until January, 1953, died at Uniontown, Pa., October 10. Mr. Maize served as an inspector and deputy secretary of the State Mining Department for many years before becoming its head. After leaving the department, he practiced as a consulting mining engineer.

Hoval A. Smith, 75, died after a long illness in Washington, D. C., his home since 1946. Mr. Smith was a mining engineer who founded the town of Warren, Ariz., where he helped to develop copper areas at the turn of the century. Before Arizona gained statehood, he was chairman of the Republican Party in the State. He helped Arizona become a member of the Union, and was nominated twice for the United States Senate.

Terry McGowan, 69, owner and operator of the McGowan Coal Co. at Consumers, Utah, until 1949, died October 18 in Salt Lake City.

Mr. McGowan began his varied and colorful mining career in the Scottish coal fields when he was 17. In 1906 he came to the United States and worked in a succession of coal and metal fields in western United States, Canada and Alaska before going to Utah in 1925. He was superintendent of the Blue Blaze Coal Co. at Consumers when it ceased operation in 1938. He then purchased the remaining Blue Blaze assets and formed his own company, which he operated until his retirement in 1949. In mid-1950 he was appointed to the Utah Liquor Control Commission and at the time of his death was chairman of that group.

Eastern and Central states

Steidle Heads Safety Board

President Eisenhower has named Edward Steidle, dean emeritus of the School of Mineral Industries of Pennsylvania State College, as chairman of the Federal Coal Mine Safety Board of Review. The appointment was made October 30, and Dean Steidle was sworn in November 6. His term is to expire on July 15, 1955.

Dean Steidle

The Safety Board, which passes on appeals under the Federal Coal Mine Safety Act, now has its full complement of three members. E. R. Price, manager of coal properties for Inland Steel, and Charles Ferguson, United Mine Workers of America safety director, were appointed earlier this year.

Dean Steidle has been connected with the coal industry since 1908, when he became a miner and mine sampler. He was in charge of various rescue cars of the U. S. Bureau of Mines during the early years of the bureau's formation. More recently he was dean of mining at the Pennsylvania State College from 1928 to 1953, retiring earlier this year.

Find First Mesabi DDH

The site of the first diamond drill hole on the Mesabi range, made in the summer of 1890 by Edmund J. Longyear, has been uncovered by Bill Holway, geologist for Oliver Iron Mining Division, U. S. Steel Corp.

While drilling with the special exploration department of the company about six miles east of Aurora, Minn., Holway noticed a pile of rock unusual to the terrain and investigated to discover bit blanks and a few pieces of core. Robert Longyear, president of E. J. Longyear Co., and son of Edmund Longyear, was contacted to verify the find. After checking the scene and his father's early maps, Longyear reported that he was absolutely sure that Holway had discovered the first diamond drill hole made on the Mesabi range.

Curtail Zinc Output

American Zinc, Lead & Smelting Co. has curtailed production of zinc at its Fairmont City, Ill., plant by approximately 25 percent. Low zinc prices, high costs and excessive imports of the metal were blamed for the cut-back.

Earlier the company had cut its zinc production by one-third at its Grandview mine in the Metaline District of Washington.

The cut-back at Fairmont City applies only to zinc smelting operations and does not affect the output of germanium and other products made there.

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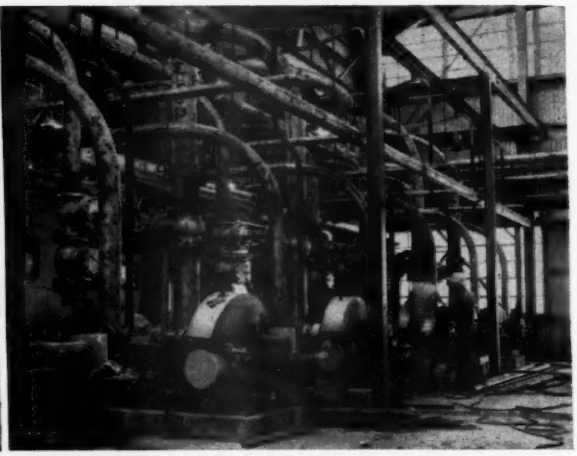
This is the heart of the development, the power plant. Here water is treated and heated to 325° F before being pumped to the wells



A look inside the power plant shows only a fraction of the miles of pipe which carry hot water to sulphur wells over a mile away

New Freeport Sulphur Mine In Operation

SULPHUR started flowing November 24 from a new mine—the largest single sulphur-mining development anywhere in the world since 1933—far down on the toe of the Mississippi delta.

After two years of engineering and construction, Freeport Sulphur Co. started pumping sulphur from a salt dome deposit deep beneath Garden Island Bay near the mouth of the Mississippi River. At peak operation, the mine is expected to yield 500,000 long tons of sulphur annually.

Garden Island Bay, 100 miles southeast of New Orleans, is one of four new salt dome projects that have resulted from Freeport's long-range exploration and development program. The undertaking required $14,000,000 to carry out because of costly engineering and construction problems.

The mine site can be reached only by boat—an hour-long trip from the nearest Mississippi delta road—or by seaplane. The only other large industrial plant within a 75-mile radius is another sulphur plant, Freeport's Grande Ecaille mine built in the marshland 20 years ago.

Before construction could begin at Garden Island Bay the marsh site of cane, grass and water hyacinth, from one to two ft above the level of the nearby Gulf of Mexico, had to be filled with hundreds of thousands of cubic yards of mud.

Then several thousand pilings, 85 to 90 ft long, were driven into the soft clay subsoil for the power plant foundation. The pilings support a 16-in. concrete mat atop which are 16-ft high concrete cells. The main floor of the plant is at this level, a necessary precaution against high water from storms and hurricanes.

To melt the sulphur, which is embedded in the caprock of a salt dome 1750 to 1850 ft below the surface, the Garden Island Bay plant is designed to pump 3,500,000 gal of superheated water (325° F) into the deposit every 24 hours.

For its water supply, Freeport taps the Mississippi, but the water must be taken from the river when salt intrusion from the gulf is at its lowest point—usually from February to June

Sulphur relay stations are the control center for the flow of water into the sulphur formation beneath the mud and water of Garden Island Bay and molten sulphur to the surface

Another view of the power plant. From here molten sulphur will be shipped in insulated barges to storage 45 miles upriver at Port Arthur. Peak production is expected to be 500,000 long tons per year

—and stored in two earthen reservoirs carved out of the marsh. These reservoirs occupy an area a mile square and are capable of holding nearly a billion gallons of water.

The mining area is more than a mile from the power plant which heats the water. Networks of pipelines carry to the outlying wells the superheated water, as well as tempering and service water and compressed air, which lifts the molten sulphur to the surface. The molten sulphur, freed of air and metered at the relay station, is pumped directly into insulated tank barges and transported 50 miles upriver for storage at Port Sulphur.

Bluefield Coal Show Plans

May 26-28 have been selected as the dates of the 1954 Southern Appalachian Industrial Exhibit, according to a recent announcement by the executive committee for the exhibit. W. L. Osborne, general manager of Algoma Coal and Coke Co., has been named general chairman of the show, which is to be held in Bluefield, W. Va. James B. Wooldridge, assistant secretary of the Pocahontas Operators Assn., was named director.

Build Titanium Plant

A $25,000,000 titanium plant is to be built at Chattanooga, Tenn., by the Crane Co. of Chicago, Ill. Cramet, Inc., a wholly owned Crane subsidiary, will operate the plant, which is scheduled for partial production in 1954 and full production in 1955.

IMI Holds 61st Meeting

THE Illinois Mining Institute held its sixty-first annual meeting in Springfield, Ill., on Friday, November 6, 1953. The usual fine crowd of mining men and equipment manufacturers gathered from all over the country to attend the one-day meeting.

President William W. Bolt after a short business meeting introduced the first speaker, Murrell Reak, assistant director, Department of Mines & Minerals, Springfield, Ill. He gave a paper entitled "Safety Digest." Reak described accident causes in Illinois coal mines and reported that roof falls caused more fatalities and injuries than any other single type of accident. He went on to say that he believed an intensified campaign by management and safety engineers aimed at making the miner conscious of the dangers surrounding him would result in fewer accidents. He added that, as a general rule, safe performance reflected operating efficiency.

"Coal for Kilowatts" by M. B. Covell, superintendent of supply service, Union Electric Co., of Missouri, was the second paper of the morning. Covell painted a bright picture for the future of coal in the electrical energy field. The annual use of electricity by domestic farm, and industrial consumers has been rising rapidly with all indications pointing to greater rises in the future.

The morning session was completed with the showing of a film produced and presented by United Electric Coal Cos., entitled "The Story of Strip Coal Mining."

Gene Traxler, chief of Flat Belting Engineering Department, The B. F. Goodrich Co., described "Current Developments in Fire Resisting Conveyor Belts," at the afternoon session. He recently completed a visit to Europe, where he studied causes and effects of belt fires. Traxler said that in Germany 60 percent of belt fires are credited to stalled belts. After listing ways and means for reducing belt fire dangers and listing safety devices to be used in fighting belt fires, Traxler concluded by saying there was little danger of a fire if standard belts were used along with the proper safety devices and if good housekeeping and good maintenance were practiced.

W. C. Campbell, assistant to vice-president in charge of operations, Old Ben Coal Corp., ended the day's program with a paper titled "Reclamation of Abandoned Works through the Use of Roof Bolts." Campbell described how the east side of Old Ben's No. 22 mine was recently reopened by cleaning up entries driven into the area before 1927. From 1927 until 1940 the entries were on return air and from 1940 until 1952, on fresh air. The cleanup began in late 1952. Caves averaged seven ft and went up to as high as 28 ft. The roof of the entries was bolted from on top of the falls, where the average clearance was 4½ ft. No standard pattern of bolts was used, but centers on the average were no less than 3½ to 4 ft. After the entries had been bolted, the rock was loaded out.

Nine thousand two hundred bolts were used in the entries and 4.7 tons of rock were loaded out per ft of entry. There were no lost-time accidents during the cleanup.

A banquet meeting was held Friday evening. IMI President, William W. Bolt, presided and Dr. Kenneth McFarland was guest speaker. His subject was "Lifting Our Sights."

Newly elected officers of the institute are: Harold L. Walker, M&N Engineering Co., president; J. W. MacDonald, vice-president in charge of engineering, Old Ben Coal Corp., vice-president; and B. E. Schonthal, secretary-treasurer. New members elected for three years to the executive board were: H. Dodge Freeman, Peabody Coal Co.; Paul Helbersleven, Sahara Coal Co.; and Ben H. Schull, director of Mines and Minerals, Springfield, Ill.

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Anthracite Impressions

"Strip Mining," one of the winning paintings in the "Portrait of Anthracite" show, by Wilmer G. Behler, a machinist at the Bethlehem Steel Co.

A steel worker, a surgeon, a housewife and a grocer are among those who swept honors at the "Portrait of Anthracite" art show which was unveiled October 11 on the main floor of the Pennsylvania Power and Light Co. headquarters building, Allentown, Pa.

Close to 1000 specially invited guests saw 162 art works ranging from oil paintings to wire sculpture, submitted by members of the Lehigh Art Alliance.

The Alliance, an organization of more than 300 artists resident within a 45-mile radius of Allentown-Bethlehem, made the anthracite industry its subject for 1953's "Art Industry" project—a continuing program of interpreting the work-life of Pennsylvania.

Model for the current "Portrait of Anthracite" was the Lehigh Navigation Coal Co.

Taconite Attracts Tourists

Taconite developments in northern Minnesota have increased tourist travel in that area by 15 percent, according to officials in the Minnesota Arrowhead Association. The plant at Beaver Bay, Minn., seems to be stellar attraction for these visitors.

Famous Breaker Gutted

On September 30, the 280-ft high Jeddo No. 5 breaker of the Jeddo Highland Coal Co., a monumental landmark since its construction in 1915, was gutted in a spectacular seven-hour blaze causing considerable damage.

Smouldering sparks from the welders' torches used to cut out old equipment in the breaker, idle since 1947, are believed to have caused the fire.

The old machinery was being removed to make way for the installation of new equipment to be used in cleaning and preparing coal silt for market. Part of the breaker will be salvaged and the reequipment program completed.

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Robena Spreads Out

Work was begun on July 14 on a new mine shaft for U. S. Steel Corp.'s Robena mine. Called the Long Shaft, the new opening is located half-way between Greensboro and Waynesburg, Pa.

Charles Dorsey, president of the R. G. Johnson Co., the firm which is constructing the shaft, explained to those attending the ground-breaking ceremony that the new shaft will be sunk to a depth of 660 ft and will have a surface dimension of approximately 41 by 18 ft. One-half the shaft will be devoted to ventilation, having both exhaust and intake airways. The other half will contain two cages for taking men to and from work. The mine's workings have not yet reached the spot where the shaft will cut into the coal, nor will it have reached there by the time the shaft is completed.

Speaking for U. S. Steel, executive vice-president H. B. Jordan said that some idea of the size of the Robena workings can be obtained from the fact that there are 300 miles of underground railroad connecting various points and faces in the mine.

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Revise DMEA Assistance

The regulations under which the Government, through the Defense Minerals Exploration Administration, will continue to help finance the cost of exploration for new deposits of strategic minerals have again been amended to restrict the program to those minerals still in shortest supply for defense needs. The new amendments also reduce the maximum percentage of the Government's participation in the approved costs of any exploration project from 90 percent to 75 percent, Secretary of the Interior Douglas McKay has announced.

In accordance with Amendment 3 to DMEA Order-1 Government assistance is now available for the following metals and minerals:

Group A, for which the Government will contribute 50 percent of the approved project costs: Chromium, copper and molybdenum;

Group B, for which the Government will contribute 75 percent of approved costs: Asbestos (chrysotile only), beryl, cobalt, columbium, manganese, mica (muscovite block and film only), nickel, platinum, tantalum, tungsten and uranium.

Secretary McKay said the practical effect of the revision of the minerals exploration program may be summarized as (1) the elimination of crocidolite and amosite types of asbestos, refractory grade bauxite, industrial diamonds and thorium from the list of minerals previously eligible for Government assistance, and (2) the shifting of all remaining commodities heretofore eligible for 90 percent Government participation into the 75 percent category, which group previously included only manganese and tungsten.

The Secretary also pointed out that all applications of record on the date of publication of Amendment 3 to DMEA Order-1 will be processed in accordance with the criteria previously in effect, and that the reduction in the percentage of Government participation for all metals and minerals listed under Group B above will apply only to those applications received after November 3, 1953.

Larger Ore Carriers

On November 9, a huge crane lowered a one-in. plate, 30 ft long and 6 ft 10 in. wide into a drydock at Lorain, Ohio, where it became the first keel plate for what will be the longest and widest freighter ever built in an American Great Lakes port. The new ore carrier, which will be 710 ft long with a beam of 75 feet, is being built for the National Steel Corp. and will be operated by the M. A. Hanna Co. She is expected to make her first trip in early 1955.

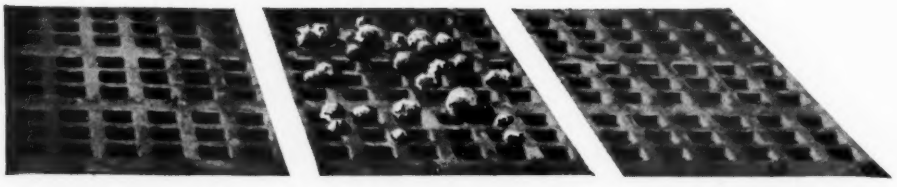
Coal Still Tops

Coal maintains its top position as the leading supplier of the nation's requirements for heat and energy in the fields where coal, oil and natural gas are competitive. Coal's share of the total in 1952 was 42.2 percent, according to a recent analysis by the Bituminous Coal Institute, as compared with 24.8 percent for petroleum products, and 27.2 percent for natural gas. Water power's share of the total in this evaluation was 5.8 percent.

These percentages of total were obtained by reducing tons of coal, barrels of oil, and cubic feet of natural gas to a common denominator—their Btu content.

U. S. consumption of coal in 1952 amounted to 453,000,000 tons, of which 418,000,000 tons were bituminous. Consumption in 1953, the Institute reported, is behind in some categories and ahead in others with the prospective total close to last year's figure. Although far below the peak reached during World War II and the years immediately following, the present level is above the 1935-39 pre-war average; and with the expanding demand for energy, which all economists foresee in the years ahead, the nation's consumption of coal is sure to increase.

Before... and... After...



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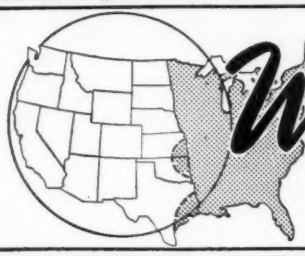


Western States

Colorado Limestone Center

The community of Marble, Colo., and its vast marble deposits have been bought from the Colorado-Yule Marble Co., by a newly formed corporation headed by Allyn Cole, of Glenwood Springs, Robert Bosworth, Denver, and Carl Norris. Formerly a prosperous marble quarrying center, the town was virtually obliterated by a flood in 1941. Cole said the marble is almost pure limestone and the first kiln will be erected on the site of the old mill next spring, giving employment to 20 or 30 persons. Expanded operations will follow, Cole went on to say.

Dog Creek Mill

Burt Hayes, who shipped the first chrome concentrates from the John Day area of Oregon to the Grants Pass ore purchasing depot in 1952, is building a small concentrating mill on Dog Creek about seven miles southeast of John Day ore. Hayes has leased the property from Ray Summers of John Day.

United Verde—Finis

Phelps Dodge Corp. has announced the sale of certain properties of the corporation at Clarkdale, Ariz., to W. L. Allison, president of Allison Steel Manufacturing Co., Phoenix, Ariz. These properties included the smelter and adjacent lands on the west side of the Verde River, the Clarkdale townsite with its residences, business area and domestic water system, and the domestic water system at Jerome.

Allison, in turn has leased the former Phelps Dodge smelting plant and town to a new corporation, the Clarkdale Sales Co., Inc., which has been formed to liquidate and dispose of the mechanical and durable goods, including motors, electrical devices and structural steel. Clarkdale Sales is headed by J. A. Ray, executive vice-president and chief engineer of Allison Steel. The lease from Allison is for five years and carries an option by Clarkdale Sales to purchase.

Ray estimated that there are up to 15,000 tons of metal at the Clarkdale, smelter, which will be reduced to scrap, in addition to about 10,000 tons of usable structural steel and several hundred tons of usable machinery. Some buildings are to be dismantled and rebuilt or refabricated and sold, and about ⅓ of the metal in the form of structures will be reduced to scrap.

At a later date, Ray said, another corporation will be organized to handle the management of the town of Clarkdale, now managed by the Upper Verde Public Utilities Co. organized under Phelps Dodge ownership. Ray indicated that every effort would be made to encourage the rental of existing establishments in Clarkdale and to bring in new businesses not available in the area at present.

Phelps Dodge closed the smelter at Clarkdale in June of 1950, and the United Verde mine at Jerome in June of this year.

Sherman and Tamarack Down

According to a recent Treasurer's Report, Day Mines, Inc., Wallace, Idaho, has suspended operations at the Sherman and Tamarack mines because remaining ore reserves are not commercial at low lead and zinc prices. Closing down of the Morning Mine by Asarco forced abandonment of the West Independence exploration project. Principal objectives of lateral easterly and southeasterly work from the 3650 level of the Morning shaft had been attained, however, without encouraging results.

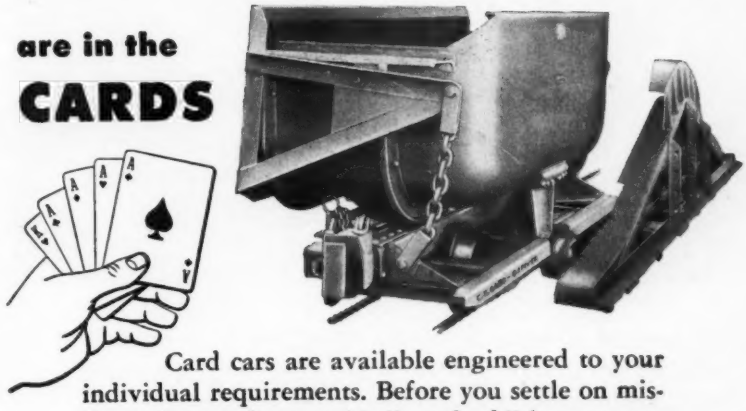
Set Idaho Safety Records

Idaho State Mine Inspector George McDowell recently praised 12 Coeur d'Alene district mines and mills for their records of 18 months of operation without a lost-time accident. This outstanding record is the result of close cooperation between management, safety engineers and employes.

Operations honored were the Morning mill at Mullan, Idaho, with the largest number, 98,468 accident-free man-hours worked; Dayrock mill; Golconda Lead; Gold Hunter; Interstate Lease; Hercules; Sherman; Polaris; Highland-Sunprise; Sidney; Spokane-Idaho and Sunset Minerals.

Lower Mine Haulage Costs

are in the CARDS



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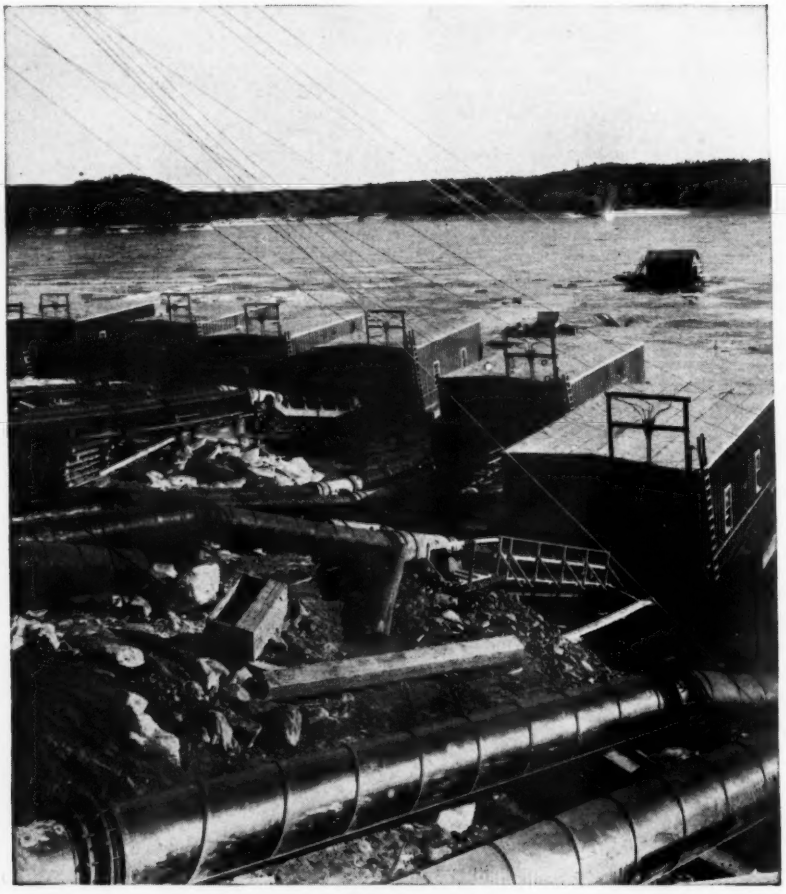

Getting rid of water in mining operations is no problem with Naylor pipe on the job. This distinctive lockseamed, spiralwelded pipe provides extra strong, light-weight lines that are easy to handle and install, yet plenty tough for rugged service like this. For moving water or moving air, you can't top Naylor pipe. Ask for Bulletin No. 507.

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Border Lord Ready

The Border Lord Mining Corp. is nearly ready to start milling ore at its property high in the Cascades in north Okanogan County, Wash. The tungsten mine is an old one, from which concentrate was shipped in 1914 to 1916, but its high elevation and isolation have always been a problem. Now the management has almost completed a 21-mile road into the camp.

Border Lord has three claims of the old Boundary mine under lease and has located seven additional claims. The extent of the vein has been traced for more than three miles. Over 1000 ft of tunnels had been driven on the property in former years. The ore is wolframite and scheelite.

During the recent rehabilitation of the mine, mill and camp, supplies either were packed in or parachuted into the camp, which is at an elevation of 8000 ft.

U-Plant for Shiprock, N. M.

Western Machinery Co., San Francisco, has announced that its Western-Knapp Engineering division has been awarded a contract to design, build and equip a plant at Shiprock, N. M., to treat uranium-bearing ore.

To be built for the Navajo Uranium division of Kerr-McGee Oil Industries, Inc. of Oklahoma City, Okla., the plant will be utilized for the production of uranium oxide for the U. S. Atomic Energy Commission. It is scheduled to be completed by December, 1954.

The new plant will use a new process for separating uranium oxide from carnotite ore. In addition to uranium, a substantial quantity of vanadium is expected as a by-product from the plant's operations.

Rehabilitate Hoopa Mine

Tuolumne Mining Co. is installing mining equipment at the Hoopa copper property in the Hoopa Indian Reservation, Humboldt County, Calif. The machinery was formerly used at a gold mine in Tuolumne County. Rehabilitation of the Hoopa began under a contract with the Defense Minerals Exploration Administration. An extensive exploratory and development program is planned and the company hopes to start producing copper next year.

Tuolumne Mining holds a lease on the Hoopa group of seven claims, comprising 143 acres. Installation of a flotation plant is reported planned if the development program discloses a satisfactory tonnage of ore. The Hoopa was first worked for gold, but later when driving a 300-ft tunnel a vein of sulphide copper ore was exposed. Ore has been shipped by various operators, but the mine was never equipped with a mill.

To Put Colo. Coal Fire Out

Wallace Beard & Co., of Grand Junction, Colo., was low bidder for a Bureau of Mines contract to smother a fire that has been burning 10 years in the abandoned Slagle coal mine, 10 miles east of Dallas Divide in Ouray County, Colo. The firm recently extinguished one coal mine fire near Baggs, Wyo., and another near Delta, Colo.

Sanger Mine Shows Promise

A five-ton mill is being installed at the Sanger mine east of Baker, Ore., to test a free milling ore showing, a report of the Oregon State Department of Geology and Minerals Industries indicates. The Sanger is one of the famous early day producers of gold in eastern Oregon. The vein to be tested was discovered several years ago and has been under development the past two summers. A length of more than 300 ft along the vein has been indicated.

Seek Uranium Ore

Moss Copper Mining Co., Provo, Utah, is diamond drilling the old prospect of the new defunct Ohio Copper Co., in Big Indian Canyon, San Juan County, Utah. The firm seeks both uranium and copper values and a recent core drill showed good values of both metals.

Milling 100 Tpd of Fluorspar

Kaiser Aluminum & Chemical Co. is milling 100 tpd of high grade fluorspar at its Fallon, Nev., flotation plant. Ore is trucked to the mill from the company's Baxter mine in the Broken Hills district, about 70 miles southeast of Fallon.

Concentrates are shipped to a refinery at Nichols, Calif. Approximately 40 men are employed and ore deposits have been developed to a depth exceeding 400 ft.

Building Tungsten Mill

Construction of a new 300-ton flotation mill four miles northwest of Glen in Beaverhead County, Mont., has begun. The mill will treat tungsten ores from the Lost Creek mines and other deposits in the area. Situated about a mile west of the Big Hole River, the plant is being built by the Minerals Engineering Co., of Grand Junction, Colo.

Roads are being built to facilitate development of outcrops in the area and to prepare for mining. A 7000-ft water line is being installed to serve the mill from adjacent wells, according to the company, and the Montana Power Co. is putting in a high tension line from Maiden Rock, in Silver Bow County.

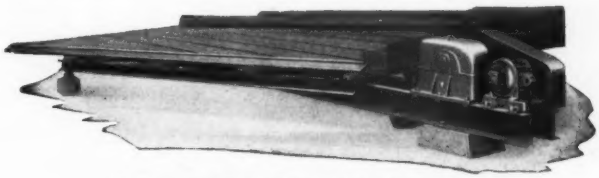
New Mexico Breaks Records

New Mexico State Mine Inspector John A. Garcia has reported that the state's mining industry broke all records by producing minerals valued at $104,044,590 during fiscal 1953. This production was $4,396,006 over the previous fiscal year, and was accomplished despite the drop in prices of lead and zinc and a decrease in coal production.

Copper led metallic production and zinc ranked second with lead third. Potash led all nonmetallics and was the leader of all minerals in monetary value with production worth $44,834,413. Second among nonmetallics was fluorspar with an $803,464 output.

Copper production was up 1398 tons; but 15,625 fewer tons of zinc were mined. Coal production too, was down and is expected to fall further this year.

Garcia reported that 3046 persons were employed in metal mines on June 30 and 3817 in nonmetallic mines. Sand and gravel producers employed 309 men and coal mines, 719.



SuperDuty Tables Reduce Cost of High Grade Concentrates

Winning high grade concentrates is only one phase of concentrating economics.

But the operator who employs SuperDuty Diagonal Deck Concentrating Tables gets such concentrates with optimum recovery at high feed rates—with exceptionally low cost.

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For full details ask for Bulletin 118B.

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The Concenco Revolving Feed Distributor is a heavily fabricated all steel machine with motor drive requiring 1 H.P. or less in operation. It effectively provides a splitting of feed into any desired number of equal portions, feeding any number of circuits or machines in battery for greater overall efficiency. Unexcelled for feeding concentrating tables.

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Cut Ophir Vein

Western Consolidated Mines, Inc., has contacted the main Ophir vein at its mine at Rocky Bar, Idaho, according to Gene Jack, president of the company. The property has been under continuous development since 1950 and surface and underground exploration has been carried out along the entire 5000-ft length of the main vein system.

A few months ago a tunnel was started which cut the main Ophir vein 165 ft from the portal. Here the vein was found to contain substantial gold and silver values. Development of the vein is continuing.

There is a 50-ton flotation mill on the property.

Treat Lead-Fluorspar Tailings

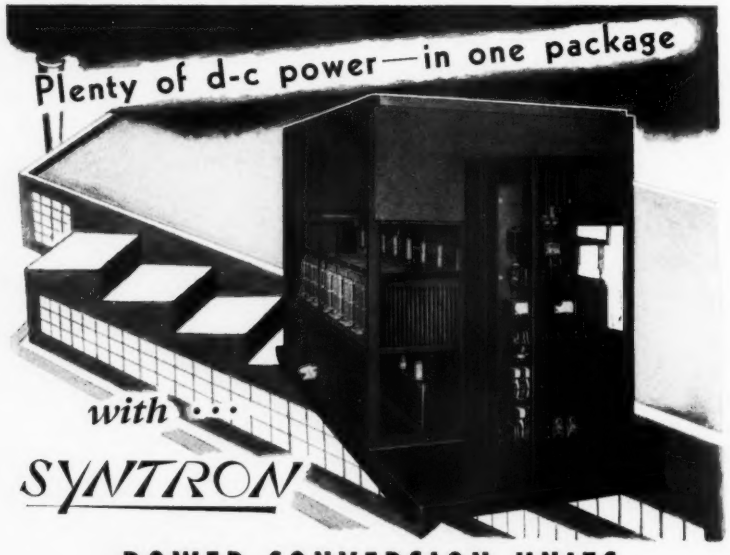
Production of fluorspar and lead from tailings of the 100-year-old Castle Dome mine and plans for the custom milling of lead containing spar ores have been announced by Kenneth Holmes, president and general manager of the new Homestake Mining Co. Present operations result from the conversion of the old Homes mill west of Winterhaven, Calif., for the handling of the lead-fluorspar ore. Mill capacity of 125 tons of ore daily is expected to be reached shortly.

Currently, two 75-ton carloads of fluorspar are shipped weekly, and lead production is a ton a day. Shipments of the acid-grade spar are divided between the Kaiser Aluminum plant in California and the Nilotex Chemical Corp. at Houston, Tex. Lead ore is shipped to the American Smelting and Refining Co. smelter at El Paso, Tex. Ore tailings from the mine, which is located 25 miles north of Yuma, Ariz., are being hauled to the Winterhaven mill. Homes estimated that the tailings alone will keep the mill supplied for three years, after which the company expects to reopen the mine.

The Winterhaven mill, built to handle gold ore from the Ogilby district of California, closed when the federal government suspended gold mining operations during World War II. Work of converting this mill was recently completed.

Goldfield Consol Plant Down

Goldfield Consolidated has closed its lead-zinc mill near Colville, Wash. The mill has a capacity of 350 tons of ore a day. Low lead and zinc prices were given as the reason for suspending operations.



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Heavy Capacity Units • Complete • Ready for Operation

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DMEA Loans at High Mark

Government loans for exploration for strategic mineral deposits in Washington, Idaho, Montana and Oregon have reached a high mark of $5,340,691.

A. E. Weissenborn, executive officer, Spokane field office, Defense Minerals Exploration Administration, made the announcement and said the figure represents the government's share of 154 exploration contracts with mine operators calling for total expenditures of $9,516,381.

Idaho leads the Northwest states with 64 DMEA contracts; Montana is second with 54 and Washington and Oregon follow with 30 and six, respectively.

Riviera Gets GSA Contract

A three-year contract, covering 3,000,000 lb of refined copper, has been awarded the Riviera Mines Co. by General Services Administration.

Riviera Mines Co. was recently organized by W. L. Allison, president of Allison Steel Co., Phoenix, Ariz., to acquire the Christmas mine in the Banner mining district of Gila County, near Winkelman, Ariz. During recent years the Christmas has been operated by the Sam Knight Mining Lease, Inc.

Under the GSA contract, the government will pay Riviera 32 cents a pound for the copper, less differentials. Terms of the contract call for the production of 600,000 lb of copper this year and 1,200,000 lb in each of the next two years. The contract ends automatically December 31, 1955, or earlier if full production has been attained.

In March of 1952, the government signed an agreement with the Sam Knight Mining Lease for production from the Christmas mine, the contract covering 2,390,000 lb of copper at 31.6 cents per pound. This contract terminated automatically when price controls were removed from copper in February, 1953. At that time about 1,150,000 lb had been produced.

Steen Property Blocks Out Ore

Charles Steen, of Moab, Utah, has announced that his company, the Utex Exploration Co., has blocked out uranium ore worth $5,000,000 on its claims in Big Indian Canyon, San Juan County, Utah. These are the deposits Steen discovered with a single drill hole last summer after four years of prospecting.

Steen has been reported to have turned down an offer of $5,000,000 for his ore properties, but has declined to identify the parties making the offer. Some assays from the property have hit as high as 17 percent uranium, but upgrading and separation will be required to produce a product that meets the AEC's specification for the discovery bonus.

To Reopen Tintic Property

Mammoth Mining Co. will reopen its Tintic District properties after being closed a decade. Steele McIntyre, Pioche, Nev., will manage the development. Gold, silver, lead and copper ores will be shipped to the Garfield smelter of AS&R for use as fluxing material.

Open Colorado Office

Sprague & Henwood Inc., Diamond Drilling Contractors and Manufacturers of Scranton, Pa., announce the opening of a new facility in Grand Junction, Colo. Robert R. Carver has been appointed manager of this new operation which is to be known as the "Western Branch."

As manager of the Western Branch, Carver is fully in charge of several large contracts this company has with the United States Geological Survey and also contracts with several private companies in this area.

Banner Mining Co.

Rico Argentine Mining Co. has purchased stock in the Banner Mining Co., according to Sherman B. Hinckley, president and general manager. Banner has a copper mine and mill at Lordsburg, N. M., and is developing a copper mine and mill near Tucson, Ariz.

Mining Idaho Heavy Sands

Idaho Titanium Co.'s new magnetic separator for the reduction of monazite sands of the Snake Basin is now operating. The plant is located at Weiser, Idaho.

In addition to the monazite sands which contain some of the rare earths, a number of other minerals are recovered from the heavy sands found in the basin. These include garnet, zircon, ilmenite, fine gold, quartz and magnetite.

Metaline Cut-Back

Both Pend Oreille Mines and Metals Co. and American Zinc, Lead and Smelting Co. have reduced their work programs from six to five days a week in the Metaline Falls, Wash., area. American Zinc, Lead and Smelting has cut its Grandview operation schedule to five days per week, one shift a day from six days per week, two shifts a day. As a result their working force will be reduced by nearly one-third.

Pend Oreille reduced its Metaline Falls mining operations to five days per week from six days and its mill operations to six days from seven. It is reported that all employes are to be retained and that construction on the third unit of the new mill will continue. The company has been on a six-day week since 1937.

Men cost more than maps

Why do things the expensive way when the more modern way—the Jack Ammann way—is better, faster and more economical? Conserve the valuable time of your highly-paid geologists and engineers.

With proper maps and air photographs of your exploration or development projects, many of your most perplexing problems can be solved right in your office, in a fraction of the time, and for only a small percentage of the cost of sending personnel to the field.

You'll be money ahead if you let us help plan your domestic and/or foreign projects and supply the air photographs and maps you need. Remember, men cost more than maps.

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Shipping Volcano Ore

About 35 carloads of copper ore have been shipped in recent months from the Volcano mine (also called the Sunnyside) in the Harshaw district of Santa Cruz County, Ariz. Present work at the Volcano is at the site of an old open cut. A vertical, 8-ft by 12-ft, shaft was sunk to a depth of 50 ft, then turned to a 63° incline to follow the ore formation. Ore was stoped from the inclined section of the shaft. In October, a new development adit was started and is being driven toward the present shaft, about 120 ft below the elevation of the shaft collar. Production has been suspended until completion of the adit.

—BOOK REVIEWS—

YEAR BOOK OF THE AMERICAN BUREAU OF METAL STATISTICS. *Published by the American Bureau of Metal Statistics, 50 Broadway, New York 4, N. Y. 120 pages. $3.00 postpaid.*

THE Thirty-Second Annual Issue of the American Bureau of Metal Statistics' Year Book is now available. Statistics included in the year book are for the year 1952. The volume contains in detail information on the production and consumption of copper, lead, zinc, gold and silver. A host of other nonferrous metals are treated although not in as much detail.

MANUAL ON ROCK BLASTING, *K. H. Fraenkel, Editor-in-Chief, Publisher—Aktiebolaget Atlas Diesel, Stockholm, Sweden.*

THIS manual is a leather-bound ring filing book with eight by ten in. loose-leaf pages arranged on the decimal system. The contributions of the various authors, all specialists in their fields, are edited for convenient reference in four languages. Indexing of the papers facilitates insertion of subsequent contributions in their proper order.

This manual is the first complete treatise dealing with the scientific, technical and practical aspects of rock blasting in mining, tunneling and excavating. The wealth of information it contains is based on projects in many countries as well as on blasting research, which has been carried on for several years. The loose-leaf form of the book was chosen with a view to correlating the rapid technical advances made in recent years with subsequent additions of new material.

Among the topics dealt with, up to the present, are rock blasting methods, which include factors affecting blasting results, such as drillability, spacing drill holes, quantity of explosives, etc. Also covered are rock blasting methods in tunneling, including heading and bench, top heading and underhand stoping, bottom heading and overhead stoping, and full-face driving. Forms for time study of drilling and blasting procedures together with practical examples make up another section under the rock blasting methods heading.

Methods for testing the drillability of rocks are given including a new testing method. In the planning of rock blasting operations, design of layout, constructional arrangements, detail planning of blasting operations, mucking drilling, charging blasting cycles, are all covered. Illustrations are given of practical drilling patterns from American, English, French, German, Italian, Norwegian, Swedish and Swiss practice.

The book also covers compressed air supply, drill steels, explosives, ventilation and has a glossary of mining terminology including definitions arranged with an alphabetical index and a bibliography. The geology section of the book, so far, contains articles on the special geological characteristics of the Alps and Jura region and the character of rock in Scandanavia.

It is hoped that eventually this manual will become a forum for specialists in rock blasting in all countries. Representing as it does a composite of blasting practices in so many countries, this book should be a welcome addition to the library of any operating mining man, and its publication represents a real service to the mining industry.

METAL STATISTICS 1953. *Published by American Metal Market, 18 Cliff St., New York 38, N. Y. 872 pages. $2.50.*

AT the top of the title page of the Forty-Sixth Annual Edition, Metal Statistics, appears this quotation by Patrick Henry, "I know no way of judging the future but by the past." This quotation sums up perfectly the value of the book, which gives complete statistical information about any metal. Metal prices given in the volume are generally based on quotations published in American Metal Market and are representative of wholesale selling prices. Statistics dealing with production and consumption are gathered from various authentic sources.

AID, TRADE AND THE TARIFF, *By Howard S. Piquet, Thomas Y. Crowell Co., New York, 1953—350 pp.*

BASED on data for 1951, this book estimates or attempts to estimate the effect on domestic industry of a temporary suspension of trade barriers. Commodities analyzed run from acetaldehyde to zirconium and include several of prime interest to miners among which are lead, zinc and mercury. The estimates assume that all variables other than tariffs and quotas remain the same as in 1951.

This last assumption was a poor one in the case of lead and zinc. The author concludes that suspension of duties and quotas for lead and zinc brought into the United States during 1951 would have only a "slight" effect on imports as the metals were in short world supply at the time. Of course, the picture has since changed drastically. Therein lies the great weakness of this book as it applies to the mining industry.

In other sections of the book, problems confronting the United States in helping the rest of the world get on its feet economically are discussed. No answers to these problems are attempted, but a clear-cut and forthright analysis of the situation is made. Therein, we believe, lies the strength of this volume.

"Higher Surveying," Volume II of PRINCIPLES AND PRACTICES OF SURVEYING, *by Charles B. Breed and George L. Hosmer, seventh edition, John Wiley & Sons, Inc., New York, 5 by 7 in., 675 pp., $7.*

CHARLES B. BREED is professor emeritus of civil engineering at Massachusetts Institute of Technology, where the late George L. Hosmer was professor of geodesy. Since 1908 "Principles and Practices of Surveying" by Breed and Hosmer has been a standard work on the topic. The eighth edition of Volume I, entitled "Elementary Surveying," was published by Wiley in 1945. Now Volume II, completely modernized to conform with latest practices and theories, has been completely revamped.

The seventh edition of "Higher Surveying" contains changes in all its five major subdivisions. These include survey control, filling in topographic details, photogrammetric survey, hydrographic surveying and stream gaging, and constructing and finishing maps. An entirely new chapter on barometric leveling emphasizes latest developments in the use of surveying altimeters. The section on photogrammetric survey has also been completely rewritten to include such information as the newest methods and instruments for constructing maps from aerial photographs. It even contains a 3-D photograph, complete with glasses for viewing same.

Because of the new arrangement of the American Nautical Almanac, the discussion of astronomical observations has been revised to include text and examples illustrating the Greenwich Hour Angle Method. The treatments of the measurement of flow of water, finishing topographic maps, and aerial cameras and photo interpretations are among the other details that serve to bring this newest edition into full accord with present practice.

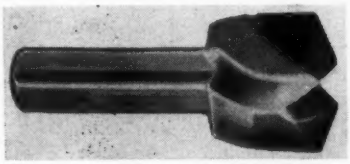
Manufacturers Forum

Honor Old Employes

Goodman Manufacturing Co. on November 4 held its eighth annual banquet for employes who have served 25 years or more. Highlights of this popular affair were the presentation of diamond pins to this year's 25 and 35-year men, and up-to-the-minute business comments by President William Goodman. Of the 220 Goodman people now wearing service pins, 63 have been on the payroll for 35 years or more and 157 for 25 years or more. All of the 220 are currently employed and represent every phase of the business—sales, service, factory and office.

New Roof Bits

New bits for more efficient drilling of mine roof have been announced by Kennametal Inc.'s mining tool division, Bedford, Pa. These include a new FDL bit design for fast drilling of some of the less difficult roof and



the style FDH bit for the harder materials. The new style FDL bit has cutting blades that track and are identical in design dimensions. This tool has a long-wearing edge on the gage and is set at a slightly positive radial rake and a slightly positive back rake angle. These design features provide very rapid rates of penetration and minimum of load on the drill unit.

The Kennametal FDH bit is modeled to accommodate the more powerful hydraulic drills and give a maximum of service life where roof drilling conditions are difficult.

Improve Tractor Performance

A newly designed Grouser Shoe for crawler tractors has been developed by Engineered Equipment Co. and is now being marketed under the name of the "Gripper." It is claimed that the wrinkled Grouser bar gives greater ground surface contact, better traction and increased resistance to side slipping. The bar is made of 13 percent manganese steel. Complete information can be had from the company at 9716 Atlantic Ave., South Gate, Calif.

Announce Fast 10-Tonner

Recognizing a need in quarry and construction work for a fast, heavy-duty truck which would be highly

maneuverable, the Dart Truck Co. of Kansas City, Mo., is now adding Model 10-S to its line.

Dart has utilized many design features in the 10-tonner which are found on its larger trucks. It uses the box section frame, the same type which is used on Dart's large ore-hauling trucks. Maneuverability in close quarters has been provided by designing the truck on a 100-in. wheel base —it turns in a radius of less than 20 ft. To assure high speed with full load, the Dart 10-S is powered with a six-cylinder Continental, 156 hp diesel engine.

Try Aluminum Pipe

By using lightweight aluminum pipe for compressed air lines, two prime contractors have been able to save time and labor in difficult blasting and grading operations on the $100,000,000 West Virginia Turnpike.

The advantage of the lightweight aluminum construction pipe can be found in its portability and ease of coupling. One or two workmen can rapidly lay a compressed air line with the 20-ft sections of pipe which weigh only 15 lb each.

A line pressure up to 130 psi is maintained in the aluminum line. The line is then tapped to run as many as six wagon drills at one time.

Wear Gas Masks and Talk

Demand-type oxygen and air masks and apparatus supplied by Mine Safety Appliances Co., Pittsburgh, henceforth will include speaking diaphragms as standard equipment, the manufacturer announces. The speaking diaphragm permits voice transmission to other workers.

MSA engineers point out that voice communication by means of speaking diaphragms has steadily gained popularity among mask users because it promotes efficiency, eliminates errors and hazards that may result from "lack of liaison," and promotes worker morale.

Sound-powered telephone equipment also may be used with the speaking diaphragms, to permit communication over longer distances. Details on the demand masks and apparatus with speaking diaphragm facepieces are available upon request, Mine Safety Appliances Co., Braddock, Thomas and Meade Streets, Pittsburgh 8, Pa.

Speed Reducers Available

A line of standard double-enveloping worm gear speed reducers, ideally suited for mining equipment power drive applications, is available from Cone-Drive Gears Division, Michigan

Tool Co., 7171 E. McNichols Road, Detroit 12, Mich.

Double-enveloping worm gear speed reducers—with the gear enveloping the worm and the worm enveloping the gear—are claimed to carry two to three times the load of conventional worm gear speed reducers of the same size.

Gear sets, shafts, bearings, mount-

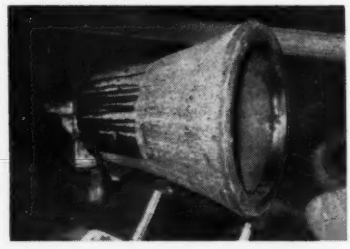
ings, etc., are interchangeable between all types of reducers of a given size, regardless of ratio, thus simplifying maintenance and reducing cost of any necessary replacement parts.

Standard Cone-Drive speed reducers are designed to operate with the pinion under or over, or the gear shaft vertical. They are available in a wide range of sizes and models, including fan-cooled and water-cooled heavy-duty types as well as double reduction units.

Capacities of the models range from fractional to 800 hp with center distances from 2-in. to 18-in. Larger sizes can be had on a special order. Reduction ratios range from 5/1 to 70/1.

Hard-Face for Wear

A new electrode particularly suited for hard-facing mining, crushing and other types of heavy equipment has been introduced by the Stoody Co. Performance records of this alloy—Coated Tube Stoodite—compare with



most electrodes selling at a much higher figure and the new material has far outworn other materials in the same price bracket, according to Stoody.

Deposition rate is reported to be far faster than can be attained with cast electrodes and the welded deposit is smooth, sound and free of pinholes or checks. Coated Tube Stoodite is readily weldable to all carbon and alloy steels including manganese. Deposits are semi-austenitic, and are not affected by ordinary heat-treat methods. Under normal welding procedure, either ac or dc, deposits show a Rockwell C hardness of 56-60; properties are retained at temperatures up to 800° F.

Descriptive literature is available from Stoody Co., Whittier, Calif.

Equip Largest Hoists

More than a million dollars worth of General Electric equipment will power and control the two largest metal-mine hoists in the United States when they begin operation in 1955 at an Arizona copper mine.

The giant hoists will operate at a rope speed of more than half a mile a minute, and be capable of delivering 18 tons of copper ore to the surface every 72 seconds. The daily output of both hoists would fill a freight train 5¼ miles long, made up of 700 gondolas carrying 50 tons apiece.

Each of the two 6000-hp, double-cylindrical drum hoists, being built by the Nordberg Manufacturing Co., will be powered by two G-E 3000-hp, 600-v, 500-rpm, d-c mine-hoist motors.

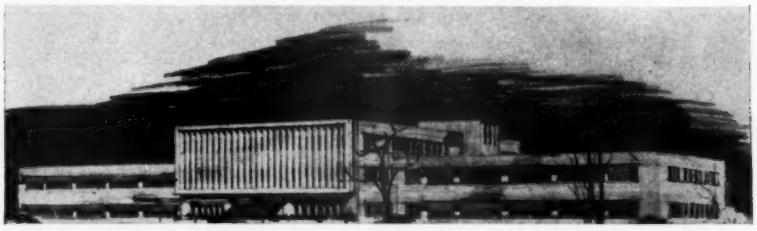
A General Electric partial-equalizing flywheel MG set—composed of two 2500 kw mine-hoist generators, a 4000-hp wound-rotor induction motor with liquid slip regulator, and a steel-plate flywheel—will furnish the 600-v d-c power for each ore hoist.

G-E also will supply complete amplistat-amplidyne control for automatic operation of the two skips in balance. The ore hoists are designed for two-level operation and will be capable of lifting the 18-ton capacity bucket up the 2425-ft shaft in 61½ seconds.

A Nordberg man-and-materials hoist with a maximum rope speed of 1500 fpm also will be installed at the mine. Two G-E 700-hp, 400 rpm d-c motors will drive this service hoist which will transport workers and materials to the working levels.

The manually-controlled service hoist will receive its power supply for a G-E synchronous motor-generator set made up of two 600-kw generators and a 1750-hp synchronous motor.

Ground Broken for New Atlas Headquarters



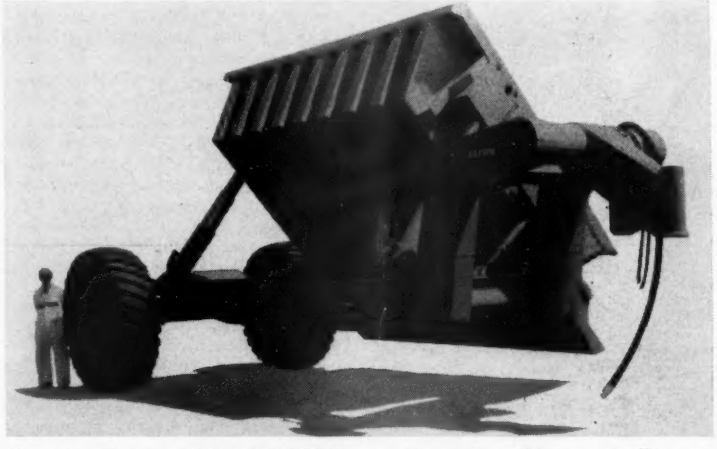
An explosives blast replaced the traditional spade as Atlas Powder Co. President Ralph K. Gottshall broke ground Nov. 25 for the firm's new administrative headquarters, to be located on a 45-acre tract in Wilmington, Del. The structure is scheduled for completion early in 1955 and will house Atlas Powder's present 400 general office employes and allow for a fifty percent future expansion in administrative staff.

Save Wire Rope

A cable reel for dozer use, designed to eliminate wastage of large quantities of wire rope due to the wearing out of small sections, is announced by LeTourneau-Westinghouse Co., Peoria, Ill.

Called the Tournarope bantam reel, its installation on a tractor is simple.

Dump on the Run



The new Easton Model TD-1832H side-dump trailer, built to work with Caterpillar DW20 tractor, has successfully passed its first on-the-job test, hauling 32-ton earth loads on a stripping and fill operation.

Big single tires, low center of gravity, and outboard-mounted hydraulic jacks assure remarkable lateral stability, even while dumping on the run. Ability to dump to the side while in motion makes this new trailer a versatile and adaptable unit for many types of off-highway hauling service. It is equally at home windrowing a 32-ton load of earth, or shuttling big loads of rock and ore.

This equipment is offered for sale through all Caterpillar dealers, and marks the first time that Easton Car & Construction Co., Easton, Pa., has departed from a direct sales policy.

This 14-in. reel, which holds 150 ft of ½-in. wire rope, is designed as a storage reel and is equipped with a bracket that can be welded or bolted on a tractor. The rope is threaded through the dead-end unit, through the sheaves and to the power control unit.

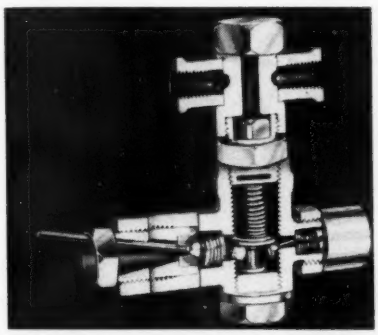
When a section of rope shows wear, usually at the PCU point, it is cut off, and an amount of rope equal to the section cut off is pulled from the storage reel, and reattached to the PCU.

This idea has worked successfully for years on scrapers and is being adapted for dozers. Before the new method was employed an operator used approximately 65 ft of wire rope to thread his blade. Installation time was costly. When the cable broke, there was usually a 50-ft section showing no wear, but unusable because of its short length.

New Air Control Valve

Because of its unique operating principle, its all-metal construction, and its flexibility of both mounting and application, an ingenious Wobble-Rod Valve (with integral exhaust) offers new possibilities to users of pneumatically-operated equipment.

The valve can be actuated (manually, mechanically or electrically) by



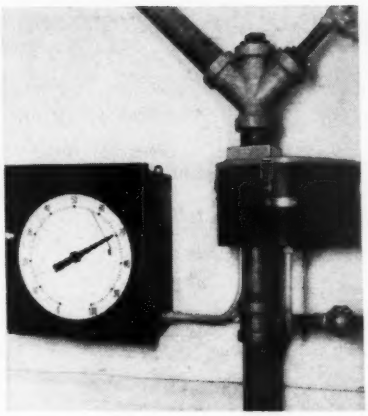
all manner of motions. It allows lateral play during a vertical throw; it permits direct linkage to rotating, oscillating, toggle, lever, slot, or straight thrust mechanisms; it can be adapted to cyclic operation by merely passing the lever-rod through an eccentric hole in a rotating disc or gear.

Full literature available from Pantex Manufacturing Co., 521 Roosevelt Ave., Pawtucket, R. I.

Control Turbidity

A new recording turbidimeter, which continuously and automatically measures and permanently records the number of particles suspended in liquids, has been announced by the General Electric Co.'s Special Products Section.

Developed by the company's General Engineering Laboratory for use in any process where turbidity is a significant factor, the G-E device can



be used with an audible or visible alarm. It provides readily available turbidity measurements for monitoring and controlling. Adjustable over a wide turbidity range, the turbidimeter has a splash-proof construction and semi-null-balance system.

Specific applications include monitoring of wastes dumped into streams and lakes to guard against pollution; water treatment plants where turbidity of incoming water determines the amount of flocculation chemicals to be added; detection of oil contamination in boiler feed water; soil erosion studies; and in any process where filter effectiveness must be constantly monitored.

— *Announcements* —

Chicago Pneumatic Tool Co. has acquired the assets of the Jacobs Manufacturing Co. of West Hartford, Conn.

C. H. Rieman was recently appointed sales manager of the Mining and Construction Divisions, **Gardner-Denver Co.**

The **Ludlow-Saylor Wire Co.**, 634 S. Newstead Ave., St. Louis 10, Mo., has changed its name to **Ludlow-Saylor Wire Cloth Co.**

The **American Ventilating Hose Co.**, a division of Callahan Zinc-Lead Co., Inc., has changed its name to **The Flexaust Co.**

Oliver United Filters, Inc., announces the acquisition for manufacture, sales and service of all rights in connection with the Centriclone, from the former owners, Equipment Engineers, Inc., San Francisco.

G. N. Dow has been appointed Chicago district sales manager, Leschen Wire Rope Division, **H. K. Porter Co., Inc.**, St. Louis.

Thaddeus S. Ullmann, assistant export manager of the **Eimco Corp.** of Salt Lake City, Utah, has been promoted to export manager. "Ted" will continue to make his headquarters in the Eimco Building in New York.

CATALOGS AND BULLETINS

BELT CONVEYORS. *Barber-Greene Co., 400 North Highland Ave., Aurora, Ill.* Catalog No. 76A describes Barber-Greene's entire range of standardized belt conveyors. Includes 60 pages of typical conveyor layouts and installation photographs. Requests should be made on company letterhead.

CENTRIFUGAL PUMPS. *Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.* Bulletin Form 7251 incorporates sectional drawings and installation views in describing the I-R class "CNTA" multi-stage centrifugal pumps. These units are specifically designed for process work and mine pumping services and are available for all pressures from 300 to 1000 psi with capacities to 700 gpm.

DIAMOND CORE DRILLS. *E. J. Longyear Co., Foshay Tower, Minneapolis, Minn.* Bulletin No. 86 lists Longyear diamond core drills in the Junior Straitline, UG Straitline and Master Straitline models. It also lists various Longyear drilling supplies and describes the new Arvela Model 52 Precision Magnetometer.

HEAVY-MEDIA SEPARATION. *American Cyanamid Co., 30 Rockfeller Plaza, New York 20.* A 32-page bulletin containing descriptions of representative Heavy-Media plants treating a variety of metallic and non-metallic ores. Includes listings of plants currently in operation and planned, and also contains a complete bibliography on Heavy-Media separation. Available without charge to interested persons. Write to the Mineral Dressing Division of American Cyanamid.

MATERIAL HANDLING AND PROCESSING EQUIPMENT. *The Jeffrey Manufacturing Co., Columbus 16, Ohio.* Designed as a reference guide in the solution of handling and processing problems, Catalog No. 860 explains Jeffrey's facilities to cope with material handling and processing problems.

MINING AND QUARRYING STEELS. *Bethlehem Steel Co., Bethlehem, Pa.* Four groups are discussed, hollow and auger drill steels for blasthole drilling; solid drill steel for drilling and for the manufacture of a variety of tools; broaching and channeller steels for quarrying dimensional stone; and stone-dressing steels for tools used in the finishing of stone for ornamental purposes.

PLASTIC PIPE. *Republic Steel Corp. 3100 East 45th St., Cleveland 27.* A 12-page booklet that tells why Republic entered the plastic pipe field, describes its product and lists various engineering and corrosion data. Ask for Adv. 603 from the Advertising Division at the above address.

STORAGE BATTERY MANUAL. *Gould-National Batteries, Inc., Trenton, N. J.* This 60-page booklet, in its sixth edition, is for users of storage batteries in industrial trucks, mine locomotives and shuttle cars. It begins with a brief treatise on the theory of the lead-acid battery and four subsequent sections give detailed instructions on the care and operation of batteries, maintenance repairs, standard and special parts and technical tables. It is free to interested persons.

VIBRATING SCREEN. *Hewitt-Robins Incorporated, Stamford, Conn.* Booklet describes Hewitt-Robins' new Style J Vibrex vibrating screen. Ask for Booklet No. 122-J.

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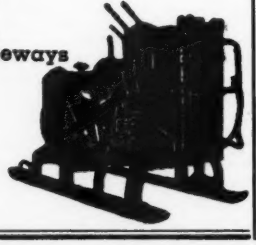

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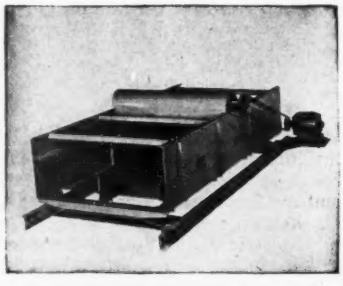

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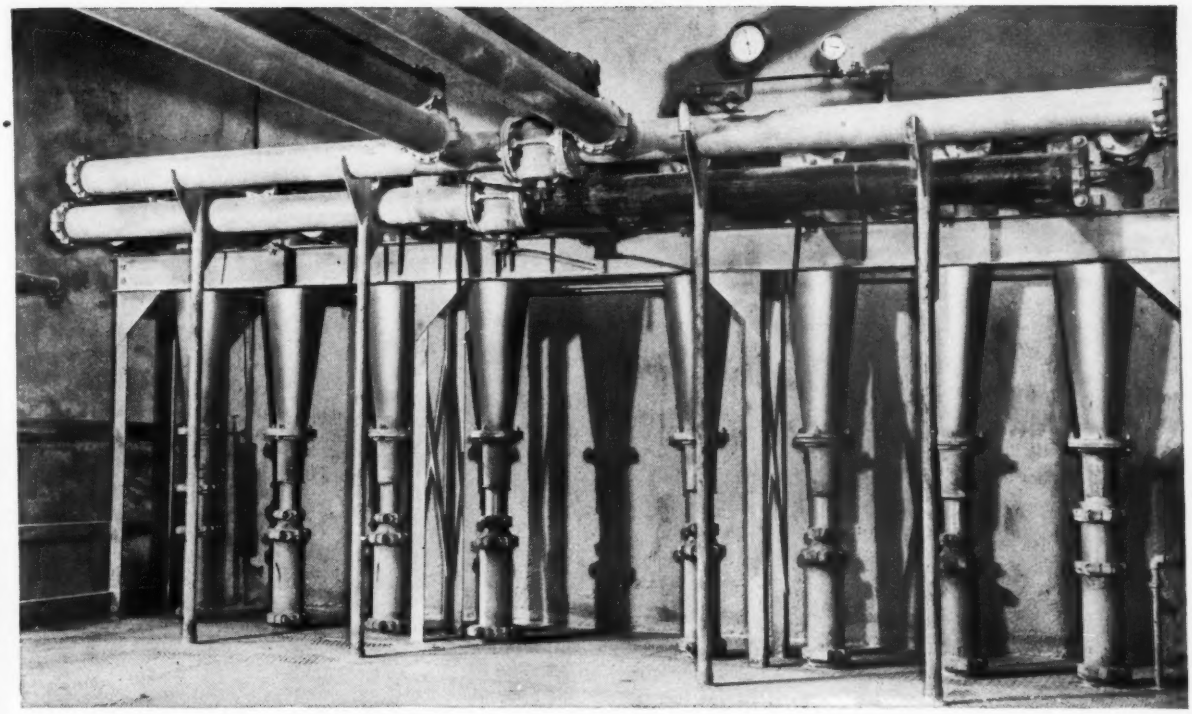

New Jersey Zinc Recovers High-Grade Agricultural Lime from Zinc-Lead Tailings with

Heyl & Patterson CYCLONE THICKENER

At the Austinville, Virginia plant of The New Jersey Zinc Company, seven 14" Heyl & Patterson Cyclone Thickeners process as much as 1,750 gallons per minute of zinc-lead tailings in the preparation of high grade agricultural limestone.

The purpose of the Cyclones is to eliminate the extremely fine material which previously had balled together to form cement-like lumps that caused breakage of spreading equipment on the farm.

Besides the recovery of this high-grade lime, the installation of Heyl & Patterson Cyclones has the additional advantage of lightening the load on the tailing pond.

This installation illustrates the versatility of Heyl & Patterson Cyclones in solving thickening, classification and recovery problems of all kinds. The low-cost, proven H&P Cyclone Thickener could easily be the answer to your particular problem.

WRITE FOR BOOKLET CT-54 FOR COMPLETE INFORMATION

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(Reineveld Centrifugal Dryer)
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Coal Crushers
Coal Preparation Plants
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Heyl & Patterson, Inc.

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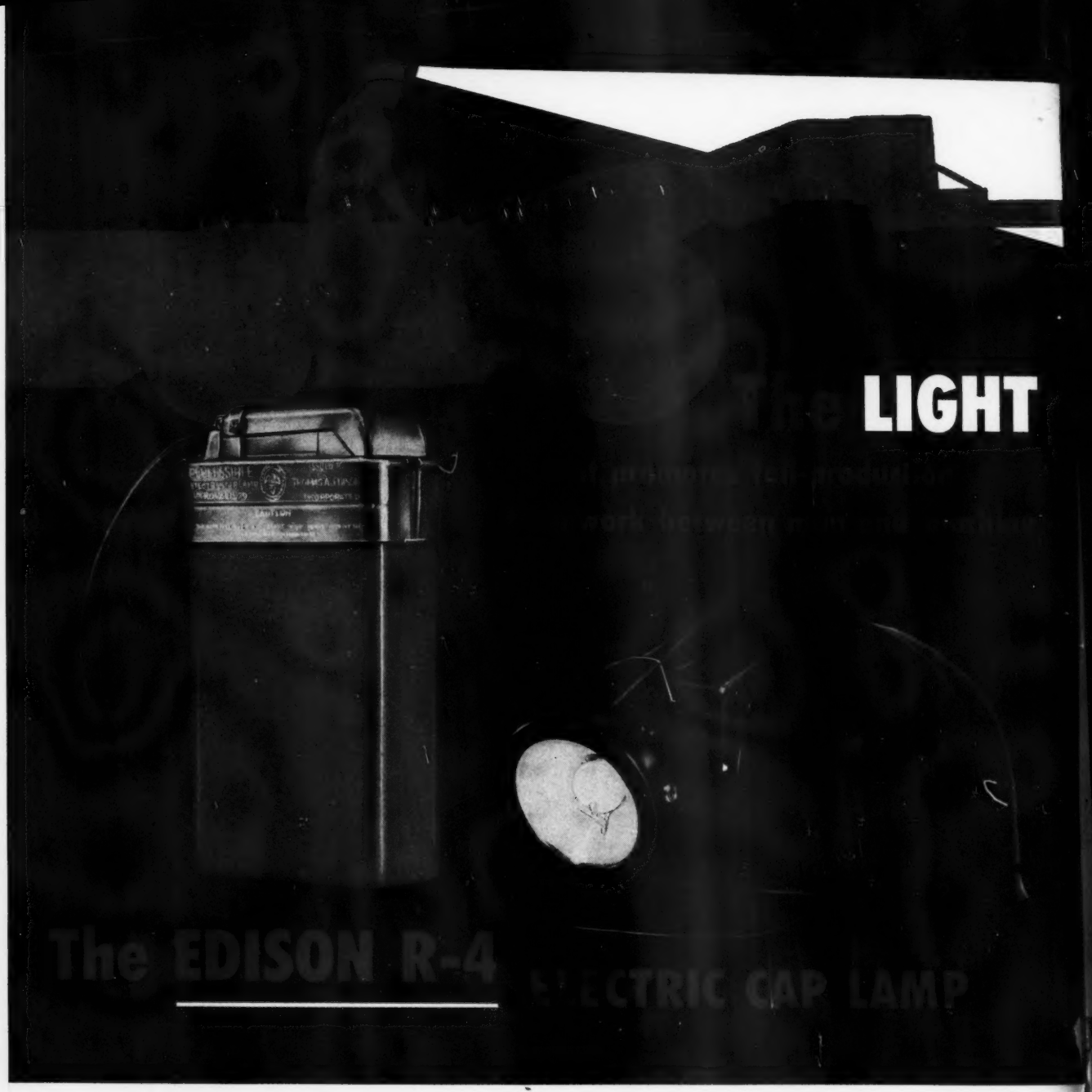

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